INSTRUCTION BOOKLET No. 78

TELEPRINTER MODELS 7 & 8

(PAGE AND TAPE)

Maintenance Instructions

CREED & CO. LTD.
TELEGRAPH HOUSE
CROYDON

PAGE VIL.

TELEPRINTER

MODELS 7 & 8
(PAGE AND TAPE)

PRINCIPLES OF OPERATION, MAINTENANCE & ADJUSTMENT INSTRUCTIONS

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WAR-TIME MEASURES

As they are not required by the Services, the two capacitors, previously fitted as standard under the base of the Teleprinter for connection as required across the windings of the operating magnet, are not now supplied.

Therefore, if the Teleprinter is being used on a Single Current Circuit, as shown in Fig. 9, a 2μF capacitor must be connected across the Terminals B4 and B9.

Similarly, when operating on a double Current basis, as shown in Fig. 10, a 0·5μF + 300 ohm capacitor should be connected across terminals B7 and B9.

Also, the contacts in the Starter Switch, shown in Fig. 8, connected to terminals A3 and A8 have been deleted, as they are not normally required.

The 6-pin plug and socket shown in diagrams 9–12 has been superseded by a 9-way type, connected in a similar manner to that shown in Fig. 13J.

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		START	CODE ELEMENTS 1 2 3 4 5	STOP
A		○	● ● ○ ○ ○	●
B	?	○	● ○ ○ ● ●	●
C	:	○	○ ● ● ● ○	●
D	WHO ARE YOU?	○	● ○ ○ ● ○	●
E	3	○	● ○ ○ ○ ○	●
F	OPTIONAL CHARACTERS	○	● ○ ● ● ○	●
G	OPTIONAL CHARACTERS	○	○ ● ○ ● ●	●
H	OPTIONAL CHARACTERS	○	○ ○ ● ○ ●	●
I	8	○	○ ● ● ○ ○	●
J	BELL	○	● ● ○ ● ○	●
K	(	○	● ● ● ● ○	●
L	)	○	○ ● ○ ○ ●	●
M	.	○	○ ○ ● ● ●	●
N	,	○	○ ○ ● ● ○	●
O	9	○	○ ○ ○ ● ●	●
P	0	○	○ ● ● ○ ●	●
Q	1	○	● ● ● ○ ●	●
R	4	○	○ ● ○ ● ○	●
S	'	○	● ○ ● ○ ○	●
T	5	○	○ ○ ○ ○ ●	●
U	7	○	● ● ● ○ ○	●
V	=	○	○ ● ● ● ●	●
W	2	○	● ● ○ ○ ●	●
X	/	○	● ○ ● ● ●	●
Y	6	○	● ○ ● ○ ●	●
Z	+	○	● ○ ○ ○ ●	●
CARRIAGE RETURN		○	○ ○ ○ ● ○	●
FIGURES		○	● ● ○ ● ●	●
LETTERS		○	● ● ● ● ●	●
LINE FEED		○	○ ● ○ ○ ○	●
SPACE		○	○ ○ ● ○ ○	●

ELEMENTS WHICH CAUSE THE SETTING OF TELEPRINTER COMBINATION DISCS OR PERFORATION OF REPERFORATOR TAPE ARE SHOWN THUS ●. THEY ARE OFTEN REFERRED TO AS MARKING ELEMENTS, WHILST THOSE OF THE OPPOSITE KIND ARE KNOWN AS SPACING ELEMENTS.

EACH GROUP OF CODE ELEMENTS IS PRECEEDED BY A START SIGNAL AND SUCCEEDED BY A STOP SIGNAL. THE LATTER MAY BE OF 1 OR 1½ UNITS DURATION.

FIG. 1.—The Start-Stop Code.

TELEPRINTER Nos. 7 and 8
(Page and Tape)

PRINCIPLES OF OPERATION

The machine operates in accordance with the start-stop system, and employs the standard start-stop code, consisting of a starting signal, five combination signals forming the intelligence code, followed by a stopping signal (Fig. 1).

In this system the synchronism between the transmitting and receiving shafts is maintained by a rough form of phase correction, which will maintain satisfactory operation between two Teleprinters, even though the motor speeds differ slightly.

TRANSMITTER.

The signals are generated by a keyboard transmitter (Fig. 2).

The original model, supplied until January 1939, was as shown in Fig. 2. Since that date the Striker Transmitter has been fitted to all Model 7 keyboards, and this unit is shown in Fig. 3. The complete unit S 2184 replaces the original transmitter unit S 1842A.

The keyboard originally fitted comprised a number of keybars K, five combination bars CB (1–5) under the control of the keybars, a transmitting cam TC controlling five selector levers SL 1–5, and start-stop lever SSL, a common operating lever CL, and a single transmitting lever TCL working between two fixed contacts M and S. The transmitting cam was adapted to be driven by a one-revolution clutch under the control of a trip bar TB.

On keyboards fitted with a " Striker Transmitter " the method of reading the signals from the combination bars is achieved in a manner identical to that employed on previous Model 7, three-row keyboards.

The construction of the operating head is also similar in that the downward extensions of the selector levers lie in the same plane as the insulated edge F (Fig. 39) of the operating lever frame which is pivoted on the pin S. This frame is also biased as before by the spring T, which tends to keep the top insulated edge to the right, but mounted on the top of the

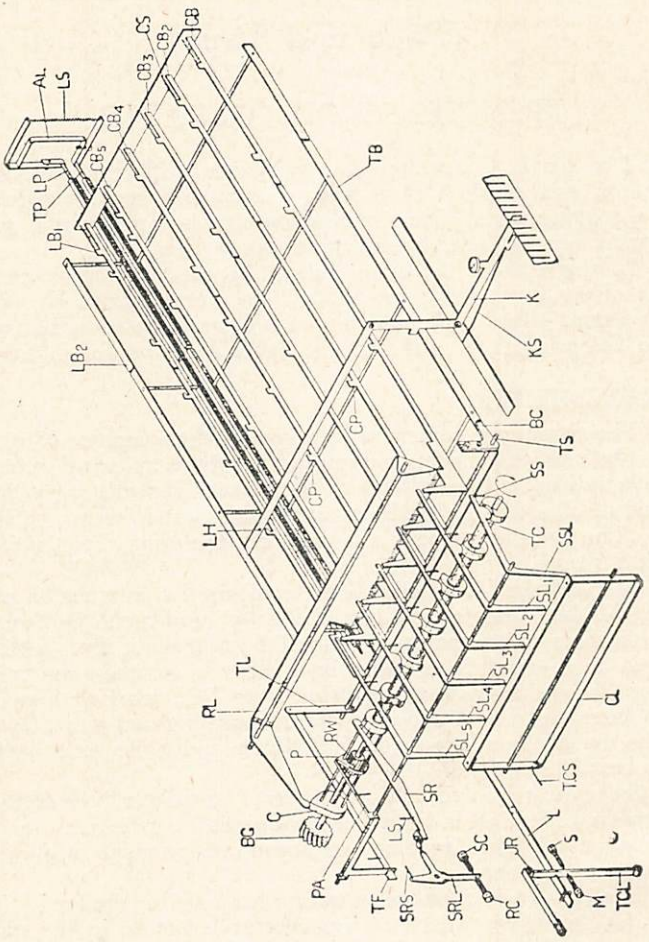


FIG. 2.—The Transmitting Mechanism.

frame is the striker C freely secured by the screw U, and guided by a slot cut in the end of the striker lever D. The Striker Lever has, as one of its components, an adjustable stop plate H which determines the movement of the striker. It also comprises an insulated extension A which is operated by a cam R on the transmitting cam shaft. (See also Fig. 3.) The striker lever, stop plate and striker lever extension are pivoted on pin V mounted in the pivot adjustment W. The Striker Lever is secured to the mounting block X by the screw B and is adjustable in a vertical direction.

The contact tongue is held firmly against either contact by means of a jockey roller O, as on the original model, but the mechanism for adjusting the bias has been improved.

The roller is mounted on a spring blade which, with its backing strips, is secured to a small bracket, which in turn is pivoted on Q. The jockey roller is kept in contact with the tongue by means of the spring Y and the whole assembly pivots on Z.

The position of the jockey roller is determined by the adjusting screw N and is held in position by the spring AA.

Upon the depression of any key, the trip bar TB releases the transmitting cam TC. The rotation of the transmitting cam firstly releases the common returning lever RL, which controls the endways movement of the combination bars.

This allows those bars, which have not been held by the keybar which has been depressed, to move to the right under the action of their springs CS. The telegraphic signal required is therefore represented by the relative endways position of the combination bars.

The start-stop selector lever is then raised by the cam and the insulated edge F, of the Striker Operating Lever is allowed to move to the right under the action of spring T, carrying the knife edge of the striker C to the right of the knife edge of the contact lever K. By this time the cam R has rotated sufficiently in an anti-clockwise direction to permit the striker lever extension A to rise sharply, under the tension of spring P, into a hollow cut into the periphery of the cam, thus bringing the striker down on to the knife edge of the contact lever and forcing the latter over to the left hand or spacing contact and thus transmitting the start signal.

NOTE.—It should be noted that the marking and spacing contacts have been reversed on this model and that the marking contact is now on the right-hand side of the contact lever.

The wiring of the Teleprinter is, however, unaffected by this change.

The further movement of the transmitter cam then releases the selector levers SL 1–5 (Fig. 2) one after the other, and these are allowed to move or are prevented from moving, according to the endways position of the corresponding combination bars.

Assuming the transmission of the letter Y (+ — + — +) the striker will be lifted by its cam as the latter continues to rotate, and the first of the selector levers E (Fig. 39.) will commence to fall at the same time. When the striker is fully lifted the vertical arm of the first selector lever will have reached the insulated edge F of the Striker Operating Lever, and as the selector lever continues to fall the operating lever will be moved to the left carrying the striker with it. The striker cam is so cut and its speed of revolution is such that 20 milliseconds after the striker was allowed to fall the first time, instituting the start signal, it will

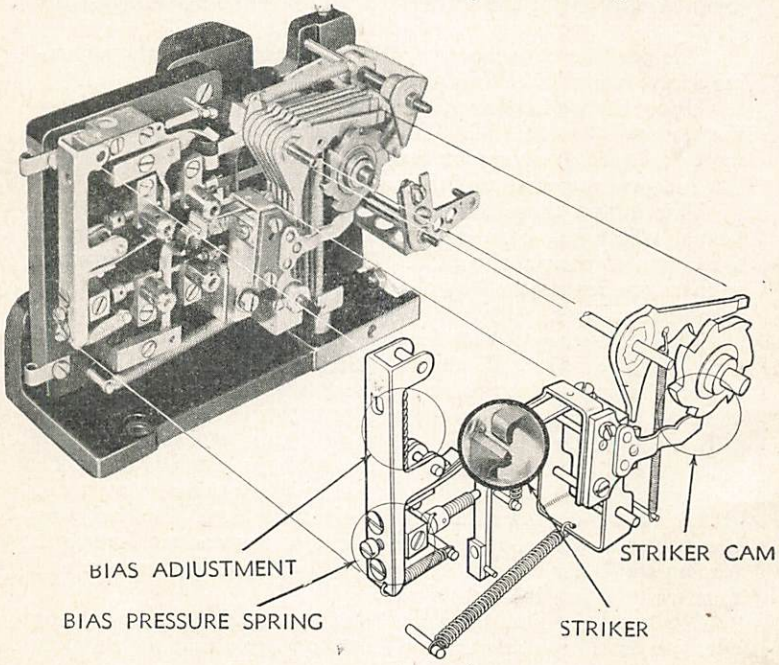


Fig 3.—Striker Transmitter.

again be allowed to fall, but this time it will force the contact lever over on to the right hand or marking contact. The first selector lever now commences to rise, and as the next signal is a spacing signal the second selector lever will be prevented from falling and the top of the Striker Operating Lever will be pulled to the right under the tension of the spring T. After a further period of 20 milliseconds the striker will again be released and the contact lever forced to the left-hand or spacing contact. It will be seen, therefore, that depending upon the selection set up on the combination bars the contact arm is moved either to the marking or the spacing contacts at precisely 20 millisecond intervals, this timing being determined by the striker lever cam R and not by the movement of the Striker Operating Lever. After the transmission of the fifth signal impulse the start-stop lever again falls, with a resultant movement of the contact tongue to the marking contact; unless the fifth signal impulse has been of a marking polarity. The cam is then brought to rest in the normal manner upon the re-engagement of the pawls with the pawl abutment.

The operation of the send-receive switch is identical to that on the keyboards with the original type of transmitter.

In order to ensure that only one group of signals is sent for every depression of a key, no matter how long that key may be held down, the transmitter cam is arranged to be driven under the control of a one-revolution clutch, as shown in Fig. 4.

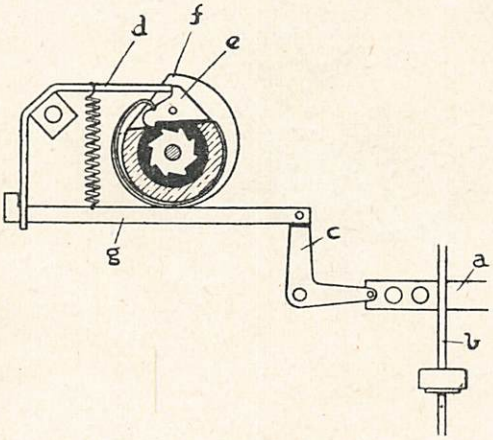


FIG. 4.—The One-Revolution Clutch (Transmitter).

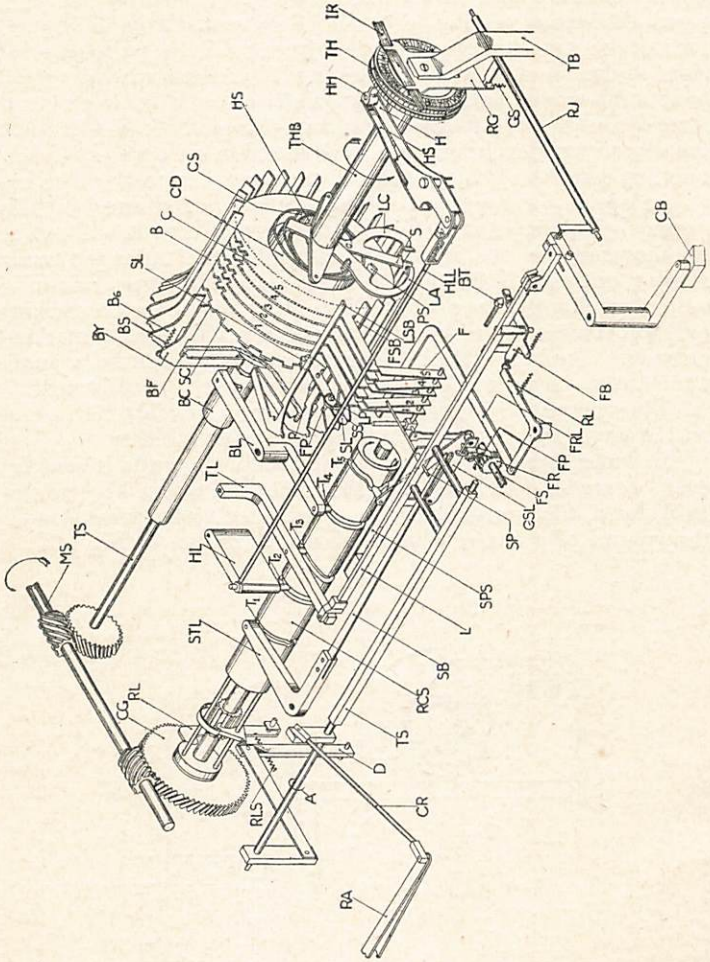


FIG. 5.—The Printer Mechanism.

When the trip bar *a* is depressed by the keybar *b*, the bell-crank *c* lifts the pawl abutment *d* out of engagement with the pawl *e*. This is thus allowed to engage with the rotating ratchet shaft. As this rotates, the cam *f* lifts the link *g* out of engagement with the pawl abutment *d*, which is thus allowed to move back into the path of the pawl so as to retract it from the ratchet wheel at the end of the revolution.

Before the cam can be released a second time, the trip bar *a* must be raised so as to re-engage the link *g* with the pawl abutment *d*.

In order to ensure accurate operation of the keyboard, two locking bars are provided. The bar LB1 (Fig. 2) is arranged to hold the key which has been depressed until the transmission of the five combination signals has been effected, and the other bar LB2 is arranged to prevent the depression of a second key until the first key has been released.

RECEIVER.

The signals, thus generated by the Transmitter, control the operating magnet, which in turn controls the receiving portion of the machine (Fig. 5).

This comprises the receiving magnet RA, the receiving cam RCS, the selecting mechanism, the translating mechanism, the printing mechanism, and the paper carriage.

The selecting mechanism comprises the striker pin SP, the striker blade SB, and the selector fingers F1–5. The pin is arranged to be moved in front of the selector fingers by the receiving cam RCS, so as to be opposite to the first selector finger during the receipt of the first combination signal, and opposite to the second, third, fourth, and fifth fingers during the receipt of the following combination signals respectively.

The striker blade SB is arranged to be operated under the control of the receiving cam so as to make a forward striking movement against the striker pin SP during the receipt of the central portion of each combination signal.

It is also arranged to be moved up and down under the control of the receiving magnet RA so as to be opposite to the striker pin when the armature is in a position corresponding to a marking signal and to be below the level of the striker pin when the armature is in a position corresponding to a spacing signal. Thus for a marking signal, the operation of the striker blade moves the striker pin so as to set the corresponding selector

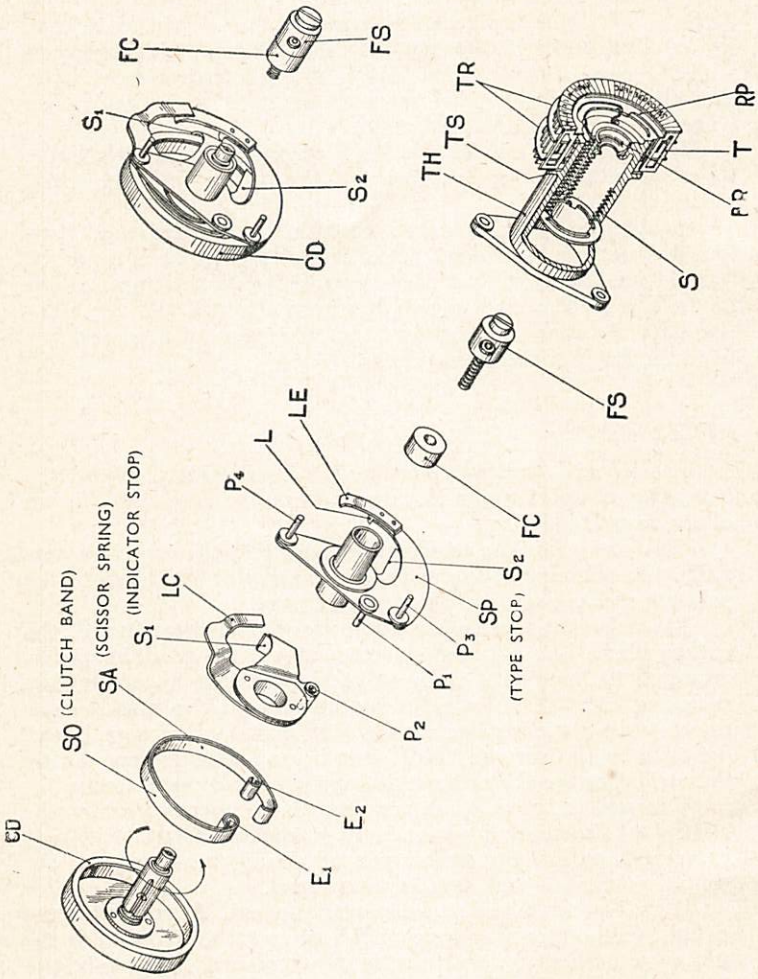


FIG. 6.—The Typehead Clutch

finger, but during a spacing signal the striker blade moves below the striker pin and the corresponding finger is not set. By this means the selector fingers are caused to take up positions corresponding to the setting of the combination bars on the keyboard transmitter.

The translating mechanism comprises five combination discs C 1–5, provided with slots cut on their periphery, against which selector bellcranks B are caused to bear under the action of springs BS. The slots are cut so that for every possible setting of the combination discs, one or other of the selector bellcranks will be able to fall into an aligned set of slots.

The typehead TH, which is driven by a friction clutch CD, is provided with a stop arm S, adapted to be caught by any selector bellcrank which has fallen into an aligned set of slots so as to be arrested, and thus bring opposite to the printing hammer the type bar required. The printing hammer H is under the control of the receiving cam, and is adapted to make a printing stroke after the typehead TH has come to rest, thus printing the required letter upon the paper carried by the paper carriage. In addition to the five combination discs, a sixth disc SC is provided, which is under the control of the figure and letter shift bellcranks in order to give the typehead 62 possible positions.

The typehead, shown in Fig. 6, is driven from the typehead clutch by means of two pins, P3, P4. The typehead clutch can be readily removed from the combination head as a complete unit, and replaced if necessary by a spare.

The typehead stop is made in two portions connected together by two springs, SA, SO, which act as a shock absorber and clutch member respectively. Portion (S1, LC, P2) moves ahead of portion (S2, L, SP, P1, P3, P4), and is thus arrested first by the selected bellcrank.

The momentum of the typehead clutch then causes the typehead to continue to rotate, thus compressing the springs SO and SA. The stored energy due to the momentum of the typehead is thus gradually abstracted, and the typehead is brought easily to rest, the abutment faces between the two portions of the typehead stop coming together so as to stop the typehead in a definite position.

The compressed spring, however, would immediately drive the typehead backwards, and, in order to prevent this, an arm SP, carrying a latch L, is provided on the typehead, and this is adapted to engage with the selected bellcrank.

The operation of this latch is controlled by a cam LC, carried by the movable portion of the typehead stop ; when the selected bellcrank is withdrawn from engagement with the typehead stop, the movable portion is immediately urged forward under the action of the spring SA. This carries the latch cam forward and permits the latch to disengage from the end of the selected bellcrank, leaving the typehead free to revolve.

The shock absorbing spring also acts as a clutch member. When the typehead is arrested, the spring is compressed and disengaged from the driving portion of the clutch. This reduces the friction after the typehead is arrested. When the typehead is released, the springs are allowed to re-engage with the driving portion of the clutch, thus re-establishing friction and causing the typehead to rotate.

Three interchangeable Units are available for printing, as follows :—

(*a*) Standard Page Unit for paper $8\frac{1}{2}''$ wide.
(*b*) Sprocket Feed Unit for paper $8\frac{1}{2}''$.
(*c*) Standard Tape Unit for paper $\frac{3}{8}''$ wide.

Page printing is effected upon a sheet or web of paper carried by a paper carriage, which is moved endways in a step-by-step manner for every letter received. This movement winds up a spring contained in a spring drum which returns the carriage to the beginning of the line, when it is released by the carriage return signal.

A feature of the paper carriage is the means provided to carry the roll of paper to and fro so as to avoid the necessity for providing the long loop of paper which would be required if the paper roll were fixed. This makes it unnecessary to cut the table on which the machine is mounted, and enables it to be used on any table just as an ordinary typewriter. It also facilitates the provision of special silencing covers where maximum quietness is required.

Sprocket Feed printing is effected upon a sheet or web of paper provided with two rows of previously perforated " registering " or guiding holes, one row being situated adjacent to and parallel with each edge of the paper and each hole in one row centrally aligned with the corresponding hole in the other row.

A special metal carriage platen is provided with 8 equally spaced projecting pins at each end mounted radially on the periphery of the platen, which engage with the holes previously punched in the paper.

Paper for sprocket feed operation is usually supplied in " packs " which have previously been folded and scored in such a manner that each folded portion represents one complete message form. A pack normally contains 250 message forms. This arrangement simplifies storage of the paper, and having been once scored and folded, the tearing off of each finished message form is facilitated.

Forms are supplied for use with carbon sheets, or the more convenient carbon-backed paper can be used. In either case four good copies can be obtained with the standard printing hammer, but if a greater number of copies is required the special " loaded " hammer is fitted, which enables up to eight to be obtained.

A special chariot can be fitted for sprocket feed machines to carry the pack of forms. This pack can weigh up to 2 lb., the number of forms in the pack being dependent upon the number of carbon copies required and the size of the forms.

In the case of the Tape Unit, the message is recorded on a paper strip, a coil of which is mounted at the back of the machine, the strip being fed past the printing head one letter space for every character received.

RADIO INTERFERENCE SUPPRESSION.

Teleprinters can be fitted with sets of components to reduce radio interference on normal broadcast frequencies. These sets can be fitted to existing machines without drilling or tapping any holes with the exception of one in the motor frame, if this has not already been provided. Full instructions for fitting the sets are supplied with the components. The sets are suitable for use on Single Current, Double Current, or Voice Frequency Telegraph circuits and for machines with either AC or DC motors.

The components are in two groups, one for suppressing the interference caused by the motor commutator and governor, and the other group for suppressing interference due to the transmitter contacts.

OPERATING CONDITIONS

GENERAL.

The Model 7 Teleprinter, being fitted with a sensitive operating magnet, will operate satisfactorily over a wide range of line conditions, without a line relay. The machine can be arranged for single or double current operation by simply adjusting the position of one spring and changing the cord connections.

The following notes are intended to facilitate the choice of the method of operation most suited to any existing conditions.

If the total volume of traffic in both directions, including all service messages, etc., is not greater than approximately 3000 words in any one hour, SIMPLEX operation may be employed. This provides facility for communication in either direction alternately.

If the volume of traffic is greater than approximately 3000 words in any one hour, and it is desired to handle it over one line, DUPLEX operation may be employed. This provides facility for communication in both directions simultaneously.

The SINGLE CURRENT closed circuit system provides the simplest method of operating Teleprinters over comparatively short lines, as it necessitates the use of only one signalling supply, which can be at either end of the line. It can generally be applied to lines up to 25 miles in length, and gives facility for simplex communication only.

Full particulars of the apparatus, voltage and current requirements and a schematic of the connections are given in the section "Circuits and Circuit Diagrams."

For longer lines, where this method of operation is desired on account of its simplicity or lower cost, or in cases where restrictions are placed on the maximum value of the transmitting voltage and current which can be applied to the line, the proposed arrangements should be referred to Creed & Company for planning.

DIRECT DOUBLE CURRENT operation is essential over long lines, and will give greater margin on short lines. It can be applied to metallic return underground circuits of K.R. (capacity in farads × resistance in ohms) up to ·03. It can also be applied to overhead lines of a similar K.R., provided that the insulation is high enough to permit a received current of at least 25 milliamperes.

If for any reason it is not possible to obtain sufficient current to operate the Teleprinter, RELAYED operation will be necessary.

Double current signalling can be employed either for SIMPLEX or DUPLEX operation.

Double current circuits are much less subject to interference from adjacent circuits than are single current circuits, as during transmission and reception the printer magnets of both machines are always under the control of the line current.

Double current operation is also more stable on lines which are subject to varying conditions, as the marking and spacing currents are usually equally affected, and there is no need to readjust for variations in the received current value.

Full particulars of the voltage, current and apparatus requirements for double current operation and schematics of different methods of connection are given in the section " Circuits and Circuit Diagrams."

If it is desired to operate over a telephone network, Voice Frequency sets can be interposed between the teleprinter and the line. A switch is arranged so as to throw the telephone receiving set out of operation, and the Voice Frequency set into operation. The transmitting contacts on the Teleprinter are arranged to control the Voice Frequency apparatus so as to send Voice Frequency signals over the line. These signals when received on the Voice Frequency apparatus at the other end of the line are rectified into direct current impulses suitable for operating the receiving printer magnet.

ALARM CONTACTS.

Two sets of contacts to close an external alarm circuit are provided and connected in parallel to Terminals 1 and 2 of Terminal Strip A (Fig. 8). One pair is closed during the operation of the Answer Back Unit, the other, by the Bell Lever of the Control Unit, on the receipt of the Signal allocated to that function.

AUTOMATIC SWITCH.

The automatic starting and stopping of the motor is obtained by means of the starter switch control unit (Figs. 31–35).

Upon receipt of the first signal the motor is started and will continue running all the time that signals are being received. Should no signals be received for a period of approximately 1½ minutes the motor will stop.

The motor can be started by an operator desirous of transmitting a message, by pressing the button let into the right-hand side of the Teleprinter cover.

The change-over contacts on the starter switch, to which connections 3 and 8 (Fig. 8) are connected, are not now fitted.

They were introduced for providing clearing facilities on Exchange systems.

MOTOR CORD.

In the interests of safety it is desirable that the socket accommodating the motor plug should be so wired that the motor starter switch intercepts the live main.

Referring to Fig. 8, it will be seen that the Red pin of the motor plug corresponds with the Red motor cord lead which terminates at the 0·5 μ.F. + 300 ohms capacitor-resistor connected across the starter switch.

The Black pin is connected *via* the Black lead directly to the motor and should be connected to the neutral or earthed main.

The large uncoloured pin is connected *via* the Brown motor cord lead to the Teleprinter frame, and should be earthed.

Since the polarity of the mains does not affect the motor performance, the above directions may be followed on D.C. systems irrespective of whether the positive or the negative main is earthed.

MOTORS.

Three standard motors are available, namely : single commercial voltage range, series wound ; two commercial voltage ranges, series wound ; and single range low voltage, D.C. shunt wound.

In order to reduce radio interference, the first two types employ a split field, *i.e.* the armature and field windings are in series, but one half of the field winding is connected on each side of the armature. Such motors use only the two inner connecting-pins, and the straps on the Teleprinter are arranged as shown in Fig. 7.

On the two-range motor straps are provided for bridging the appropriate field tappings. These motors can be supplied on request for two A.C. voltage ranges, for two D.C. voltage ranges, or for one A.C. and one D.C. voltage range, provided the D.C. range is not for a higher voltage than the A.C. range.

When the motors are required for D.C. voltages of less than 40 volts, the consequent high current values in the armature circuit would render series governing undesirable. In such cases

shunt-wound motors are used and shunt governing employed—that is, the armature and field coils are arranged in parallel, the governing resistance being in series with the field coils. The connections of the motor and governing circuits are then as shown in Fig. 7/3. A shunt-type governor S1933 must always be used with these motors.

The internal wiring of the Teleprinter is identical for both series and shunt-wound motors, except that the value of the governing resistance is different.

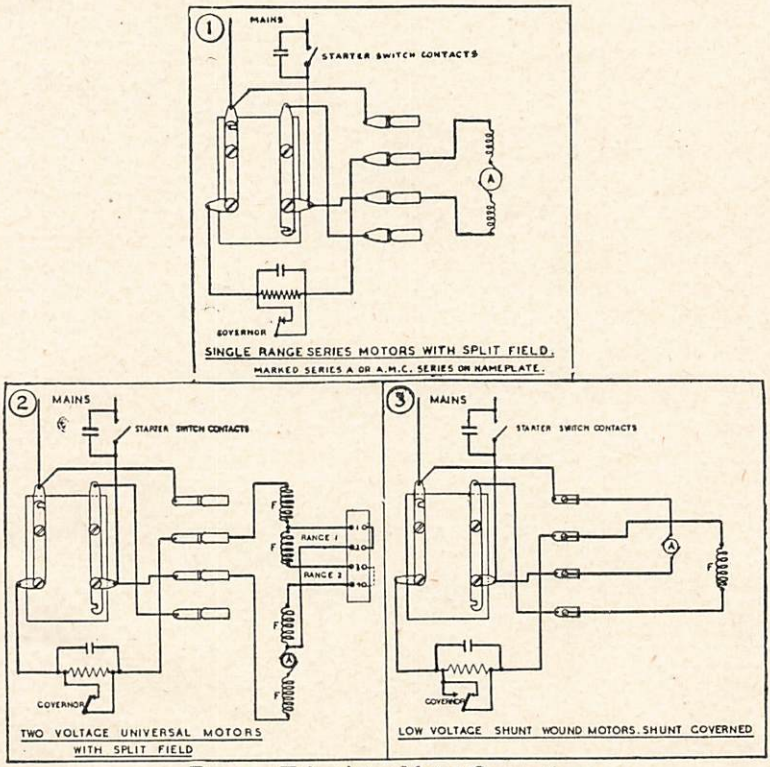


FIG. 7.—Teleprinter Motor Connections.

CIRCUITS AND CIRCUIT DIAGRAMS

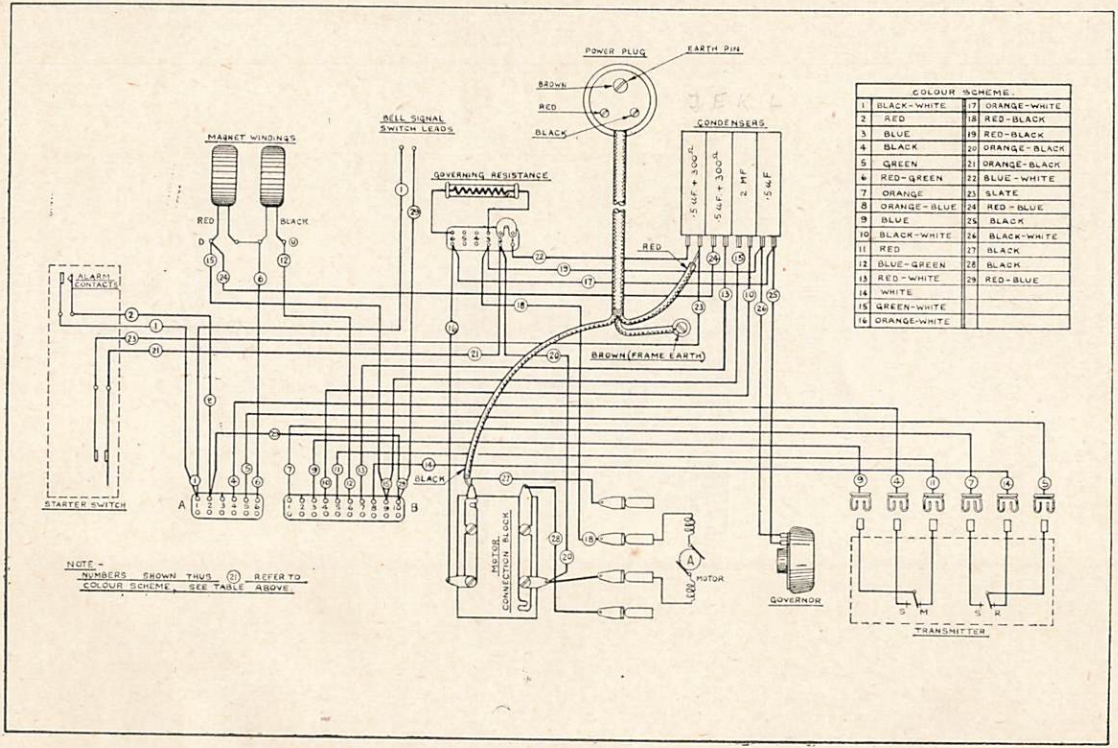


FIG. 8.—Internal Wiring of Teleprinter 7 (all models) (Page and Tape). *See also* FIG. 7.

NOTE.—Internal Wiring of Teleprinter 8 (all models) is identical, but no Transmitter Unit is fitted

CIRCUITS AND CIRCUIT DIAGRAMS (FIGS. 8–13).

The internal connections of Teleprinters Model 7 and 8 are shown in Fig. 8.

Figs. 9–13 show the internal strapping of the terminal blocks and the external connections, by means of the six-way cord, to these blocks.

The normal connections of the six-way cord to the terminal strips of Model 8 Receiving only Teleprinters, are, for D.C., shown in the lower section of Fig. 10. For S.C. operation, see Fig. 9.

The following are the various methods of operation :—

(*a*) Single current closed circuit.
(*b*) Direct double current simplex.
(*c*) Relayed double current simplex.
(*d*) Relayed double current differential duplex without local record.
(*e*) Relayed double current differential duplex with local record.
(*f*) Direct double current simplex with delayed action send-receive switch.
(*g*) Relayed double current simplex with delayed action send-receive switch.

The top sections of each diagram show schematically the circuit arrangements, whilst the bottom sections show the connections of the Teleprinter cord to terminal strips A and B under the machine.

The resistances S1, S2, S5, and S6 shown in the diagrams are protection resistances, and should have a value of approximately 2 ohms per volt of the signalling supply.

The type of signalling supply employed depends upon the power supply available at the Teleprinter location.

If the power supply is Direct Current the use of a battery of 10 ampere-hours capacity charged from the mains is recommended to supply the signalling current for operating one Teleprinter. Where the Teleprinter is operating for a long period each day a spare battery should be provided with means to change over from one to the other.

Batteries must be disconnected from the mains before they are connected to a circuit.

If the power is alternating, the use of signalling rectifiers is recommended.

NOTE.—The drawings and descriptions specify only the main apparatus requirements. Small accessory items, such as meters, etc., will be required in addition.

If desired the accessory equipment can be supplied by Creed & Company mounted in a unit.

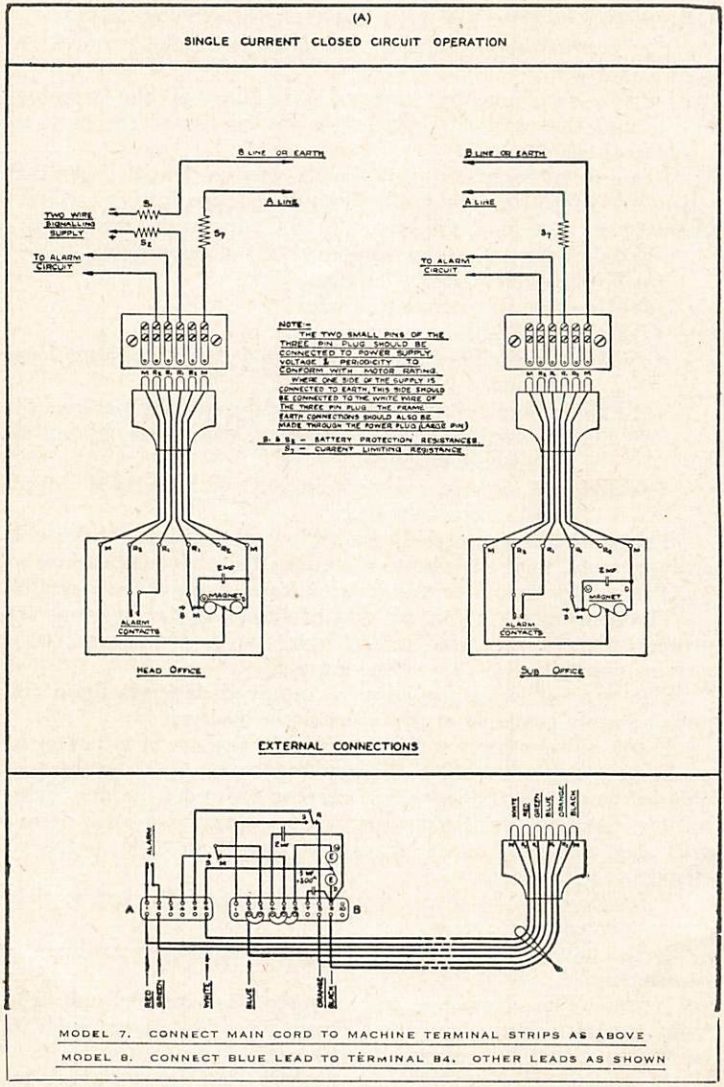

(A)
SINGLE CURRENT CLOSED CIRCUIT OPERATION
B LINE OR EARTH
A LINE
TWO WIRE SIGNALLING SUPPLY
TO ALARM CIRCUIT
NOTE:-
THE TWO SMALL PINS OF THE THREE PIN PLUG SHOULD BE CONNECTED TO POWER SUPPLY VOLTAGE & PERIODICITY TO CONFORM WITH MOTOR RATING
WHERE ONE SIDE OF THE SUPPLY IS CONNECTED TO EARTH, THIS SIDE SHOULD BE CONNECTED TO THE WHITE WIRE OF THE THREE PIN PLUG. THE FRAME EARTH CONNECTIONS SHOULD ALSO BE MADE THROUGH THE POWER PLUG (LARGE PIN)
S1 & S2 - BATTERY PROTECTION RESISTANCES
S3 - CURRENT LIMITING RESISTANCE
EMF
MAGNETO
ALARM CONTACTS
HEAD OFFICE
SUB OFFICE
EXTERNAL CONNECTIONS
ALARM
A
B
RED (MAINS)
WHITE
BLUE
ORANGE (MAINS)
BLACK
WHITE
RED (MAINS)
ORANGE (MAINS)
BLUE
BLACK
MODEL 7. CONNECT MAIN CORD TO MACHINE TERMINAL STRIPS AS ABOVE
MODEL 8. CONNECT BLUE LEAD TO TERMINAL B4. OTHER LEADS AS SHOWN

FIG. 9.—Single Current Closed Circuit Operation.

(*a*) SINGLE CURRENT CLOSED CIRCUIT OPERATION.

The connections are shown in Fig. 9.

The apparatus requirements at each end of the circuit are as follows :—

1 Teleprinter Model No. 7, page or tape.
1 Line current limiting resistance.

At one end of the line it will be necessary to provide a signalling supply and protection resistances in addition to the above.

The signalling supply should have a two-wire output of not less than 50 volts.

Resistances S7 should be such that the steady line current is not less than 30 m.a.

To obtain satisfactory operation on very short lines or under test conditions, the equivalent of at least 5 miles of standard cable should be introduced into the circuit (R = 440 ohms K = ·33μF).

When such a length of standard cable is employed, with a signalling voltage of 50 volts and two protection resistances of 100 ohms each, the current-limiting resistances should be 300 ohms each.

Before operation can be effected the bias spring must be fitted between the bias-adjusting bracket and the operating magnet link.

The spring should be connected in the lower left-hand hole in the operating magnet link (see Fig. 27), and on to the right-hand pin in the adjusting rod of the bias-adjusting bracket (see Fig. 26).

This will cause the operating magnet armature to be held in the spacing position until the battery is switched into circuit.

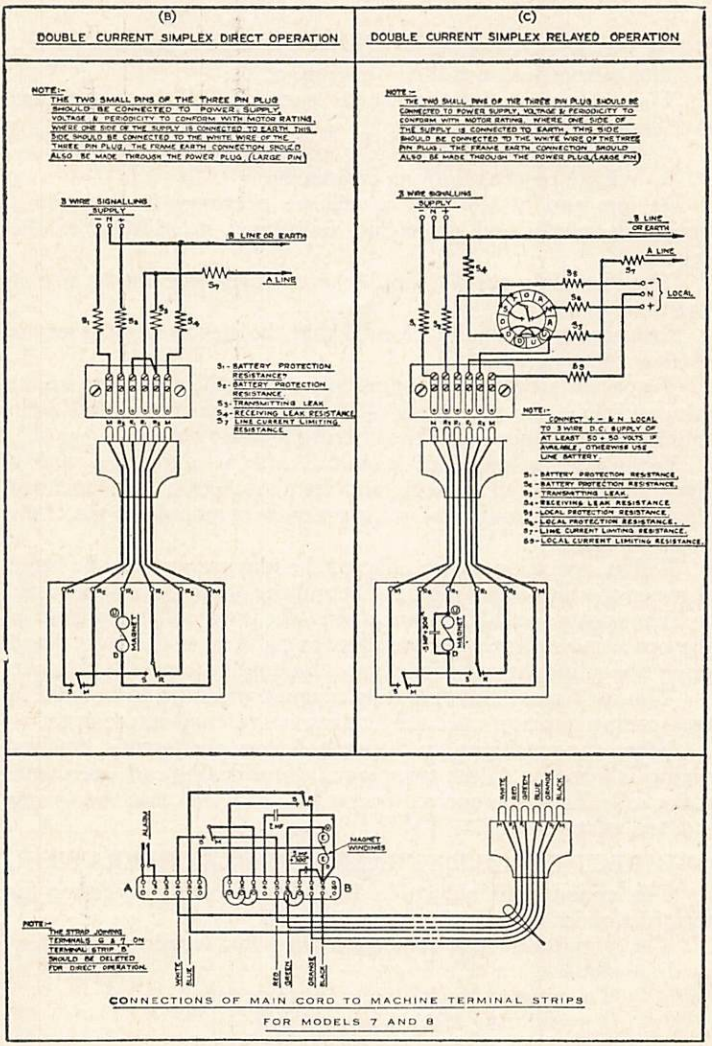
When the machines are dispatched from the factory, the bias spring is fitted on to the two pins in the adjusting rod, unless the order calls for single current operation. In this case the spring is fitted as required.

(*b*) DIRECT DOUBLE CURRENT SIMPLEX OPERATION.

The connections shown in Fig. 10B are suitable either for terminal or intermediate stations.

The apparatus requirements either for terminal or intermediate stations are as follows :—

1 Teleprinter Model No. 7, page or tape.
1 Transmitting leak resistance S3.
1 Receiving current limiting resistance S4.
1 Line current limiting resistance S7 (if necessary).
1 Signalling supply.
2 Protection resistances S1 and S2.


(B)
DOUBLE CURRENT SIMPLEX DIRECT OPERATION
(C)
DOUBLE CURRENT SIMPLEX RELAYED OPERATION
NOTE:- THE TWO SMALL PINS OF THE THREE PIN PLUG SHOULD BE CONNECTED TO POWER SUPPLY VOLTAGE & PERIODICITY TO CONFORM WITH MOTOR RATING, WHERE ONE SIDE OF THE SUPPLY IS CONNECTED TO EARTH THIS SIDE SHOULD BE CONNECTED TO THE WHITE WIRE OF THE THREE PIN PLUG. THE FRAME EARTH CONNECTION SHOULD ALSO BE MADE THROUGH THE POWER PLUG (LARGE PIN)
3 WIRE SIGNALLING SUPPLY
B LINE OR EARTH
A LINE
LOCAL
S1 - BATTERY PROTECTION RESISTANCE
S2 - BATTERY PROTECTION RESISTANCE
S3 - TRANSMITTING LEAK
S4 - RECEIVING LEAK RESISTANCE
S7 - LINE CURRENT LIMITING RESISTANCE
S8 - LOCAL CURRENT LIMITING RESISTANCE
CONNECT + - & N LOCAL TO 3 WIRE D.C. SUPPLY OF AT LEAST 50 + 50 VOLTS IF AVAILABLE, OTHERWISE USE LINE BATTERY
MAGNET WINDINGS
ALARM
NOTE:- THE STRAP JOINING TERMINALS 6 & 7 ON TERMINAL STRIP B SHOULD BE DELETED FOR DIRECT OPERATION.
WHITE
RED
BLUE
ORANGE
BLACK

CONNECTIONS OF MAIN CORD TO MACHINE TERMINAL STRIPS

FOR MODELS 7 AND 8

FIG. 10.

B—Direct Double Current Simplex Operation.
C—Relayed Double Current Simplex Operation.

It is recommended that a signalling supply having a three-wire output of not less than 2 × 50 volts be employed.

Resistance S7 is employed to bring the line circuit resistance up to a desired value; for example, to equalise the resistances of several lines each of which may be connected to the same Teleprinter. It should be set to the desired value before the values of the other resistances are adjusted.

Resistance S4 should be set to limit the current received from the distant station to approximately 25 milliamperes under the worst line conditions.

Resistance S3 should be adjusted after the value of S4 has been fixed, to limit the current through the home Teleprinter windings to approximately 25 m.a.

If a 2 × 50 volt battery be used, the total resistance of S3 and S4 should be approximately 1800 ohms to give 25 m.a.

(*c*) RELAYED DOUBLE CURRENT SIMPLEX OPERATION.

The connections shown in Fig. 10C are suitable either for terminal or intermediate stations.

In addition to the apparatus specified in section (b), the following equipment is required :—

1 Creed Relay Model No. 27/c.
1 Local circuit current limiting resistance S9.
2 Protection resistances S5 and S6.

The marking and spacing contacts of the relay may be connected (through protection resistances S5 and S6) to the signalling supply if it is not less than 2 × 50 volts, or to a separate 3-wire D.C. supply.

Resistance S7 is employed in the manner specified for direct operation. Resistance S4 should be set to limit the current received from the distant station to approximately 5 m.a. under the worst line conditions.

Resistance S3 should be set after the value of S4 has been fixed to limit the current through the home receiving relay windings to approximately 5 m.a.

If a 2 × 50 volt battery is employed the joint resistance of S3 and S4 should be approximately 10,000 ohms to give 5 m.a.

Resistance S9 should be set to furnish current of approximately 25 milliamperes through the Teleprinter magnet windings.

If a 2 × 50 volt local battery is used its value will be approximately 1800 ohms.

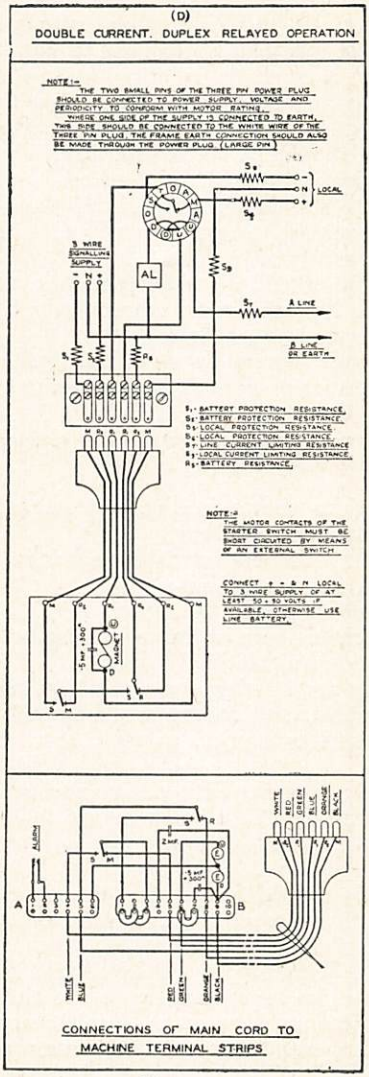

(D)
DOUBLE CURRENT. DUPLEX RELAYED OPERATION
NOTE:-
THE TWO SMALL PINS OF THE THREE PIN POWER PLUG SHOULD BE CONNECTED TO POWER SUPPLY VOLTAGE AND PERIODICITY TO CONFORM WITH MOTOR RATING.
WHERE ONE SIDE OF THE SUPPLY IS CONNECTED TO EARTH, THIS SIDE SHOULD BE CONNECTED TO THE WHITE WIRE OF THE THREE PIN PLUG. THE FRAME EARTH CONNECTION SHOULD ALSO BE MADE THROUGH THE POWER PLUG (LARGE PIN)
3 WIRE SIGNALLING SUPPLY
AL
LOCAL
A LINE
B LINE OR EARTH
S_1 BATTERY PROTECTION RESISTANCE
S_2 BATTERY PROTECTION RESISTANCE
S_5 LOCAL PROTECTION RESISTANCE
S_6 LOCAL PROTECTION RESISTANCE
S_7 LINE CURRENT LIMITING RESISTANCE
S_9 LOCAL CURRENT LIMITING RESISTANCE
R_8 BATTERY RESISTANCE
NOTE:-
THE MOTOR CONTACTS OF THE STARTER SWITCH MUST BE SHORT CIRCUITED BY MEANS OF AN EXTERNAL SWITCH
CONNECT + - & N LOCAL TO 3 WIRE SUPPLY OF AT LEAST 50 + 50 VOLTS - IF AVAILABLE, OTHERWISE USE LINE BATTERY.
.5 MF + 300Ω
MAGNET
Alarm
WHITE
RED
GREEN
BLUE
ORANGE
BLACK
A
B
WHITE
BLUE
RED
GREEN
ORANGE
BLACK
CONNECTIONS OF MAIN CORD TO MACHINE TERMINAL STRIPS

FIG. 11.

D—Relayed Double Current Differential Duplex Operation (without Local Record)

(*d*) RELAYED DOUBLE CURRENT DIFFERENTIAL DUPLEX OPERATION (WITHOUT LOCAL RECORD).

The connections are as shown in Fig. 11D.

The apparatus requirements for a terminal station are as follows :—

1 Teleprinter Model No. 7 Tape.
1 Line current limiting resistance S7.
1 Signalling supply.
2 Protection resistances S1 and S2.
1 Differential milliamperemeter (not shown).
1 Battery resistance R5.
1 Artificial line (AL).
1 Single current key for balancing (not shown).
1 Creed Relay Model No. 27/c.
1 Local current limiting resistance S9.
2 Protection resistances S5 and S6.

It is recommended that a signalling supply having a three-wire output of at least 2 × 50 volts be employed.

The received line current should be limited by resistance S7 to approximately 10 milliamperes when one machine only is transmitting.

It is generally advisable to duplicate this resistance in the artificial line circuit, both resistances being controlled by the same knob.

The marking and spacing contacts of the relay may be connected (through protection resistances S5 and S6) to the line signalling supply, provided that the supply is not less than 2 × 50 volts. Alternatively they may be connected through similar resistances to an independent supply.

Resistance S9 should be set to furnish a current of approximately 25 m.a. through the Teleprinter magnet windings.

If the local signalling supply is 2 × 50 volts, resistance S9 should be approximately 1800 ohms.

The automatic starting switch cannot be used as it is not under the control of the outgoing transmission, and the Teleprinter motor would stop in the event of a long pause in the distant transmitter.

The switch can be put out of action by sliding the collar along the starter spindle as far as it will go and clamping it after ensuring that the pin in the weight-lifting arm is clear of the worm wheel. This prevents the pin from entering the holes in the worm wheel and thus being raised to operate the switch.

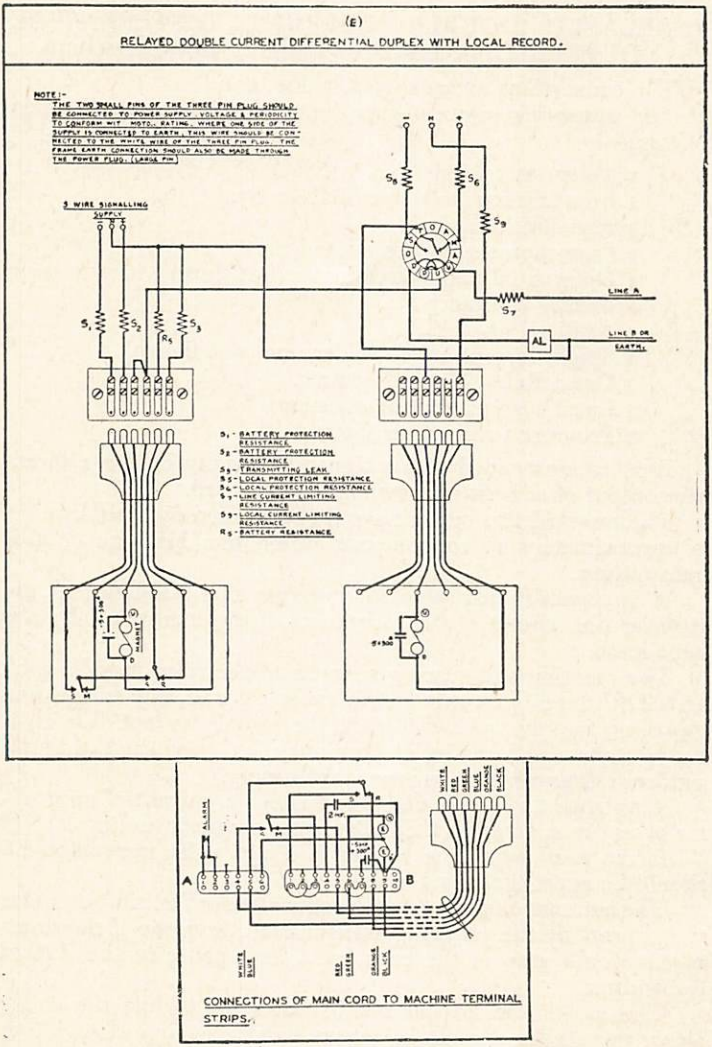

(E)
RELAYED DOUBLE CURRENT DIFFERENTIAL DUPLEX WITH LOCAL RECORD.
NOTE:-
THE TWO SMALL PINS OF THE THREE PIN PLUG SHOULD BE CONNECTED TO POWER SUPPLY VOLTAGE & PERIODICITY TO CONFORM WITH MOTOR RATING. WHERE ONE SIDE OF THE SUPPLY IS CONNECTED TO EARTH, THIS WIRE SHOULD BE CONNECTED TO THE WHITE WIRE OF THE THREE PIN PLUG. THE FRAME EARTH CONNECTION SHOULD ALSO BE MADE THROUGH THE POWER PLUG. (LARGE PIN)
3 WIRE SIGNALLING SUPPLY
LINE A
LINE B OR EARTH
AL
S1 - BATTERY PROTECTION RESISTANCE
S2 - BATTERY PROTECTION RESISTANCE
S3 - TRANSMITTING LEAK
S5 - LOCAL PROTECTION RESISTANCE
S6 - LOCAL PROTECTION RESISTANCE
S7 - LINE CURRENT LIMITING RESISTANCE
S9 - LOCAL CURRENT LIMITING RESISTANCE
RS - BATTERY RESISTANCE
A
B
WHITE
RED
GREEN
BLUE
ORANGE
BLACK
CONNECTIONS OF MAIN CORD TO MACHINE TERMINAL STRIPS.

FIG. 12.

E—Relayed Double Current Differential Duplex Operation (with Local Record).

(*e*) RELAYED DOUBLE CURRENT DIFFERENTIAL DUPLEX OPERATION (WITH LOCAL RECORD).

The connections are shown in Fig. 12E.

The apparatus requirements are as follows :—

1 Teleprinter Model No. 7, page or tape.
1 Teleprinter Model No. 8, page or tape.
1 Line current limiting resistance S7.
1 Signalling supply.
2 Protection resistances S1, S2.
1 Differential milliamperemeter (not shown).
1 Battery resistance R5.
1 Artificial line (AL).
1 Single current key for balancing (not shown).
1 Local record current limiting resistance S3.
1 Creed Relay Model No. 27/c.
1 Local circuit limiting resistance S9.
2 Protection resistances S5 and S6.

The line signalling supply should not be less than 2 × 50 volts.

The received current should be limited by resistance S7 to approximately 10 milliamperes when one machine only is transmitting.

It is generally advisable to duplicate this resistance in the artificial line circuit, both resistances being controlled by the same knob.

The marking and spacing contacts of the relay may be connected (through protection resistances S5 and S6) to the line signalling supply, provided the supply is not less than 2 × 50 volts. Alternatively they may be connected through similar resistances to an independent supply.

Resistance S9 should be set to furnish a current of approximately 25 m.a. through the Teleprinter magnet winding.

If the local signalling supply is 2 × 50 volts, resistance S9 should be approximately 1800 ohms.

The send-receive switch is arranged to disconnect the battery and connect an equivalent resistance R5 in its place when the machine is not transmitting. This reduces the battery drain.

This arrangement cannot be used, however, if the line is subject to severe interference, in which case the transmitting armature should be connected directly to the mid-point of the receiving relay by strapping terminals A5 and B3. Resistance R5 must be deleted.

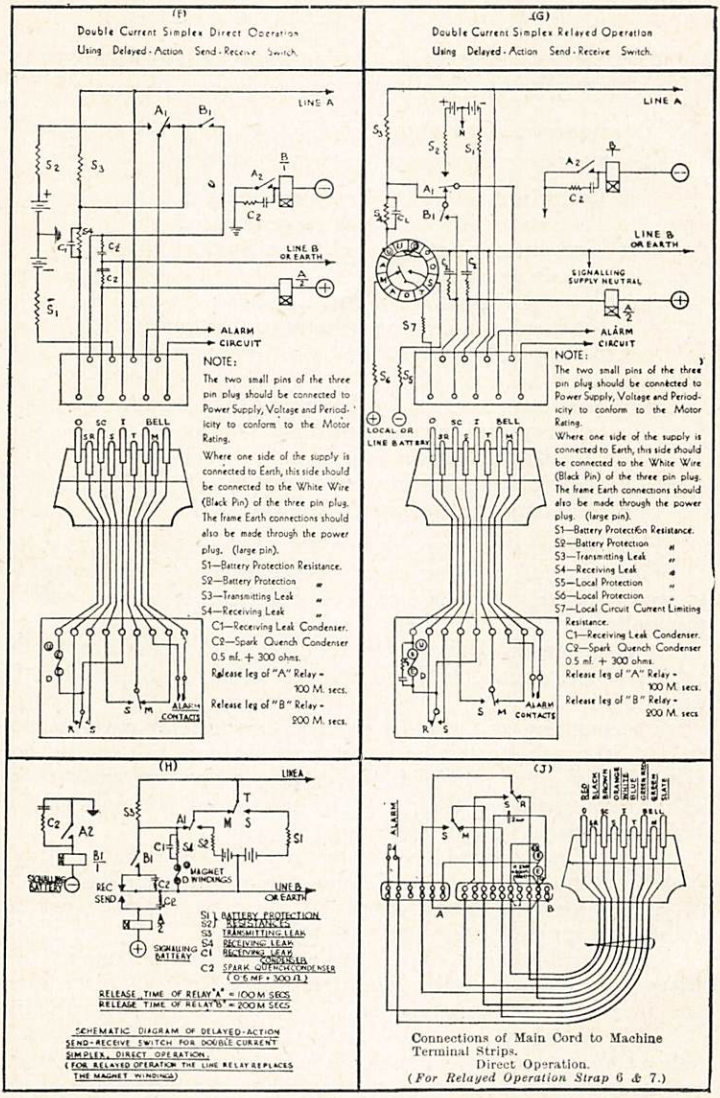

(F)
Double Current Simplex Direct Operation
Using Delayed-Action Send-Receive Switch.
LINE A
LINE B OR EARTH
ALARM CIRCUIT
NOTE:
The two small pins of the three pin plug should be connected to Power Supply, Voltage and Periodicity to conform to the Motor Rating.
Where one side of the supply is connected to Earth, this side should be connected to the White Wire (Black Pin) of the three pin plug. The frame Earth connections should also be made through the power plug. (large pin).
S1—Battery Protection Resistance.
S2—Battery Protection "
S3—Transmitting Leak "
S4—Receiving Leak "
C1—Receiving Leak Condenser.
C2—Spark Quench Condenser 0.5 mf. + 300 ohms.
Release leg of "A" Relay - 100 M. secs.
Release leg of "B" Relay - 200 M. secs.
BELL
ALARM CONTACTS
(G)
Double Current Simplex Relayed Operation
Using Delayed-Action Send-Receive Switch.
LINE A
LINE B OR EARTH
SIGNALLING SUPPLY NEUTRAL
ALARM CIRCUIT
LOCAL OR LINE BATTERY
NOTE:
The two small pins of the three pin plug should be connected to Power Supply, Voltage and Periodicity to conform to the Motor Rating.
Where one side of the supply is connected to Earth, this side should be connected to the White Wire (Black Pin) of the three pin plug. The frame Earth connections should also be made through the power plug. (large pin).
S1—Battery Protection Resistance.
S2—Battery Protection "
S3—Transmitting Leak "
S4—Receiving Leak "
S5—Local Protection "
S6—Local Protection "
S7—Local Circuit Current Limiting Resistance.
C1—Receiving Leak Condenser.
C2—Spark Quench Condenser 0.5 mf. + 300 ohms.
Release leg of "A" Relay - 100 M. secs.
Release leg of "B" Relay - 200 M. secs
BELL
ALARM CONTACTS
(H)
LINE A
LINE B OR EARTH
MAGNET WINDINGS
SIGNALLING BATTERY
REC
SEND
S1 BATTERY PROTECTION RESISTANCES
S2
S3 TRANSMITTING LEAK
S4 RECEIVING LEAK
C1 RECEIVING LEAK CONDENSER
C2 SPARK QUENCH CONDENSER (0.5 MF + 300 Ω)
RELEASE TIME OF RELAY "A" = 100 M SECS
RELEASE TIME OF RELAY "B" = 200 M SECS
SCHEMATIC DIAGRAM OF DELAYED-ACTION SEND-RECEIVE SWITCH FOR DOUBLE CURRENT SIMPLEX DIRECT OPERATION.
(FOR RELAYED OPERATION THE LINE RELAY REPLACES THE MAGNET WINDINGS)
(J)
ALARM
BELL
RED
BLACK
ORANGE
YELLOW
GREEN
BLUE
Connections of Main Cord to Machine Terminal Strips.
Direct Operation.
(For Relayed Operation Strap 6 & 7.)

FIG. 13.

F—Direct Double Current Simplex Operation using Delayed Action Send-Receive Switch.

G—Relayed Double Current Simplex Operation using Delayed Action Send-Receive Switch.

(*f*) and (*g*) DOUBLE CURRENT SIMPLEX OPERATION WITH DELAYED ACTION SEND - RECEIVE SWITCH (Fig. 13).

Difficulty may be experienced when using the automatic send-receive switch on a line having appreciable capacity due to the fact that on the disconnection of the signalling supply from the line by the operation of the switch an oscillating discharge takes place through the operating magnet windings causing errors in the local record.

The resistance in series with the operating magnet should be kept as high as possible to limit the effect of this discharge, provided that it does not reduce the line current below 20 milliamperes for direct operation or below 5 milliamperes in relayed operation under the worst line conditions.

If this is not practicable, the send-receive switch must be operated in conjunction with slow acting relays.

The schematic arrangement for Double Current Simplex (Direct) operation is shown at H, Fig. 13, in which relay A is a slow release relay with two contacts, A1 and A2, and with a time lag of 100 m.s., and relay B is a slow release relay having a time lag of 200 milliseconds.

When the keyboard is operated the send-receive switch armature moves to " send," and relay A is energised, removing the short circuit from the transmitting leak at contacts A and joining the positive side of the battery to the marking contact of the transmitter.

The closure of contact A2 energises relay B and contacts B1 on closing prepare a short circuit for the receiving leak and the Teleprinter magnet windings.

When the transmission of the signal is completed the armature of the send-receive switch moves to " receive." This de-energises relay A, and also completes the short circuit across the teleprinter magnet windings and the receiving leak. Contacts A, in reversing their position, re-introduce the short circuit on the transmitting leak, and contacts A2, in opening, de-energises relay B. The time lag of relay B is sufficient, however, to hold the contacts B1 closed until the line has discharged *via* contacts A1, B, thus eliminating the effects of this discharge upon the magnet windings. Finally, contacts B1 open and remove the short circuit from the magnet windings.

For relayed double current simplex operation the windings of the Teleprinter should be replaced by the line relay windings, the Teleprinter being connected in the local circuit.

Detailed wiring diagrams for both direct and relayed operation are given at F and G (Fig. 13). The connections of the 9-point plug and cord to the machine terminal strips are shown at J.

The functions and values of the various resistances are the same as those given in Sections b and c for double current operation without the delayed action send-receive switch.

The signalling battery may be used for operating the switching relays A and B. If this is done one relay should be connected to each side of the battery to equalise the load.

NOTE.—When the delayed action send-receive switch is used, a nine-way connecting cord and plug and socket are required in place of the usual six-way fitments.

MAINTENANCE INSTRUCTIONS

MAINTENANCE

As ball races are provided on all main bearings, this Teleprinter requires much less frequent lubrication than previous models. Avoid excessive lubrication. A few drops of oil at a time are sufficient.

The machine should receive systematic maintenance as follows :—

AFTER 100 HOURS OPERATION :

1. Clean the platen spindle and air piston thoroughly and apply *a few drops* of thin oil to the spindle, but not to the piston.
2. Clean and burnish the transmitting contacts and verify that the adjustment is correct. (Refer to page 58 for contact adjustment.)
3. Remove all surplus oil and clean the machine.
4. Apply *a few drops* of oil to all oil cups and oil holes.
5. Apply a few drops of oil to the selecting fingers and the finger guide pin. Also to the grooves in the transmitting cam.
   NOTE.—For general lubrication purposes Shell Oil C.Y.2 or Wakefield's Castrol XL or a similar medium oil should be used.
6. Smear the knife edges of the striker lever and transmitter tongue with Lubricant No. 5 (Mobilgrease No. 2 or Shell grease " Retinax A ").

Experience has shown that faulty operation of the transmitting tongue is frequently due to lack of lubrication of the knife edges of the transmitting tongue and striker and not to the grooving of the jockey roller, as is generally assumed.

Therefore, *on each routine maintenance visit* or whenever the transmitting unit requires attention, a film of Lubricant No. 5 should be applied to the knife edges of the transmitting tongue and striker.

During overhaul or repair of the teleprinter, when the transmitting unit is dismantled, as light film of Lubricant No. 5 should be applied to the surfaces of the knife edges on the transmitting tongue and striker and also to the slot in the striker stop plate. The pivot pin of the jockey roller should be removed, cleaned and greased with the same lubricant. During assembly a trace of medium oil (Lubricant No. 2) should be applied to the pivots of the armature lever, and one drop to the striker pivot (Item BV, Fig. 27, Part List 1078). Care must be taken, however, to remove any surplus oil, which otherwise would creep on to the Contact Spring beneath the Transmitting Tongue.

7. Clean the motor commutator with a rough dry rag.
Brush away dust from the governor brushes and clean the governor contact rings with a rag.

8. Grease the latch cam of the Typehead with Lubricant No. 5 (see Fig. 14).

Grease the coupling discs with Lubricant No. 5. Apply a little Lubricant No. 5 to the end of the bell-crank lifting collar where it engages with the bell cranks.

See also Lubrication Chart, Fig. 55.

TYPES.

Should the typehead be dismantled the type shanks must be lightly smeared with oil before the types are reassembled in their rack. They should never be allowed, even for a few minutes, to operate in a dry condition, nor should they be lubricated by dropping oil on to them. A film of oil, only, is required.

MOTOR.

After about 1000 hours operation the motor should be removed for cleaning.

Take off the fan-end bearing plate and thoroughly clean the commutator and brush-holder plate of all dust.

See that the commutator is in good condition and, if necessary, clean it with fine glass paper. (Emery paper should *never* be used.)

See that the brushes move freely in their holders, and that they are seating properly on the commutator. If a brush is badly worn it should be renewed and reseated.

SPEED AND GOVERNOR.

Should it be suspected that the speed of the motor is incorrect, check by means of the 643 V.M.P. stroboscope supplied with machine. This should be used in the following manner: Hold the stroboscope firmly near the top with the left hand, and place the observation slit as near to the eye as possible. Flick the reed of the stroboscope with a finger of the right hand and observe the white spot painted on the typehead shaft driving gear wheel.

If the spot appears to be stationary the motor speed is correct. Apparent anti-clockwise movement of the spot indicates that the motor is running too slow, and apparent clockwise movement indicates that the motor is running too fast.

The speed of the governor is accurately set before it leaves the factory, and the adjustment should not be altered until it is definitely decided that incorrect speed is due to the governor.

Before any adjustment is made the voltage of the supply should be checked and corrected if necessary, the motor commutator should be examined and cleaned if dirty, and the governor contacts should be burnished.

If the speed is still incorrect, hold the magnet armature in the mark or L.H. position and short-circuit the governor brush connections, when, in the case of series or universal motors, the speed should increase to a speed considerably above the governed speed. The motor may now have to be switched off before the speed will decrease. Great care must be exercised to ensure that the armature does not move from the marking stop whilst this test is being made. In the case of a shunt motor, the speed should decrease to a speed less than the governed speed. If the governor is removed, the converse of the above should take place.

If the voltage is correct and the speed does not vary as stated above, then the governing circuit should be checked to ascertain that there are no short circuits or breaks.

When all the above points have been checked and found in order or corrected, and the speed is still incorrect, the tension of the governor spring should be altered. The procedure is as follows: Slacken the clamp plate screws, insert a small screwdriver through the hole in the plate, and turn the governor spring adjusting screw in a clockwise direction to increase the speed, or in an anti-clockwise direction to decrease the speed. It will be found that one complete turn of this screw will alter the speed by approximately 30 r.p.m.

After 1000 hours operation the governor cover should be removed and the mechanism thoroughly cleaned.

The contact faces should be cleaned with fine emery paper or a smooth oil stone.

INK RIBBON.

Under normal conditions, the life of the ink ribbon will depend on the quality and colour of the ink and the amount it is used. Should the ribbon show any signs of being torn or frayed at the edge, it should be renewed at once irrespective of how long it has been used.

When a ribbon becomes frayed at the edge, the adjustment of the ribbon jumper should be checked (refer to paragraph 4, adjustment section). The standard black ribbon should have a life of at least thirty hours continuous running at 66 words per minute.

GENERAL.

After 1000 hours operation the machine should be overhauled. The apparatus units should be removed from the main base, and all parts thoroughly cleaned. No. 4 lubricant should be applied to all ball races and the apparatus adjustments carefully checked.

LOCALISATION OF TELEPRINTER FAULTS.

When investigating Teleprinter failures it is important to establish immediately whether they are due to

(*a*) Incorrect speed ;
(*b*) Unsuitable line conditions ; or
(*c*) Incorrect adjustment of the machines.

To determine this, first check the speed of each machine, and if necessary adjust the governor as described on page 39.

If the speed of the home machine is too slow its local record signals will be correct, but the fifth selecting finger will frequently be set in error during reception from the distant station. The reception on the distant machine will not be so badly affected. Correspondingly if the speed of the home machine is too fast the distant record will experience the same type of failure.

If the failures still continue after the speeds have been verified, proceed to localise the fault in the following manner :—

(1)	Home machine	Local record correct—reception faulty	Line faulty.
	Distant machine	Local record correct—reception faulty	
(2)	Home machine	Local record faulty—reception correct	Home transmitter faulty.
	Distant machine	Local record correct—reception faulty	
(3)	Home machine	Local record faulty—reception faulty	Home receiver faulty.
	Distant machine	Local record correct—reception correct	
(4)	Home machine	Local record correct—reception faulty	Distant transmitter faulty.
	Distant machine	Local record faulty—reception correct	
(5)	Home machine	Local record correct—reception correct	Distant receiver faulty.
	Distant machine	Local record faulty—reception faulty	
(6)	Local record at each end faulty but reception correct.		See (*f*) and (*g*) in circuit section.

If condition (1) exists the condition of the line should be verified and the received current checked to the figures given in the section dealing with circuits.

If condition (2) exists, first check that the signalling supply voltage is correct when loaded, and in the case of double current operation that the voltage on the marking and the spacing contacts are equal when supplying current to the line.

Then check the transmitter adjustments and make them conform to those specified in Sections 16 and 17. Also verify the send-receive switch adjustments as shown in Section 18.

If condition (3) exists the trouble may be found, in the selecting, translating, or printing mechanisms.

Conditions 4 and 5 are similar to conditions 2 and 3, but call for adjustment at the distant end.

The cause of condition 6 is explained, and the means for overcoming it are given in (*f*) and (*g*) in the circuit section.

SELECTING MECHANISM FAULTS.

1. Too many fingers set (marking bias) or too few fingers set (spacing bias) are due either to the operating magnet being biased or to the striker blade exerting an uneven back pressure on the operating magnet armature.

The adjustment of these items should be made to conform to those specified in Sections 8 and 11 respectively.

2. *Fifth Finger set in error*, giving V for C, L for column, M for N, etc., irregularly. This is due to one of the following causes :—

(*a*) The receiving pawl spring is too strong or too weak. This should be checked to the value given in Fig. 30, and if necessary either set or changed.

(*b*) The receiving pawls sticky. The cam sleeve should be removed and thoroughly cleaned, and the pawls checked for freedom.

(*c*) The retention lever set to give insufficient clearance (" u," Fig. 30). This should be set in accordance with the adjustment given in Section No. 13.

3. *First Finger not set.*—This may be due to the fingers slipping backward in their slots whilst being raised under the combs. This is most evident in the case of the first finger, but may affect the others as well to a less frequent extent.

The finger springs should be checked to see that they are not twisted nor too weak (see Adjustment 5 (*d*), and the slots in which the fingers move checked to see that they are perfectly square and parallel.

4. *Irregular Mis-selections.*—These may be due to stiffness in the operating magnet or the trip shaft bearings. The cone shape bearing at the rear end of the trip shaft is set at the factory and should not be altered, but the front bearing is provided with a hexagon head. This bearing can be adjusted by means of a spanner so that the trip shaft has no end play but is quite free in its bearings.

TRANSLATING MECHANISM FAULTS.

If wrong letters are printed although the selecting mechanism is operating satisfactorily, firstly, find out whether the correct bell-crank is dropping. If this is not the case the trouble is in the translating mechanism, and the following points should be checked :—

(*a*) Verify the adjustment of the bellcrank lift. See Section 5 (*b*).

(*b*) Ascertain that the combs will fall freely under the action of their returning springs when the bellcranks are lifted. If they are sticky the combination unit should be cleaned.

(*c*) Verify the adjustment of the finger lift. See Section 5 (*c*).

(*d*) See that the bellcranks concerned are not sticky.

PRINTING MECHANISM FAULTS.

If the correct bellcrank is actuated but the correct letter is not printed, see whether the typehead clutch latches with the actuated bellcrank. If it does not, check the clutch adjustment as described in Section 1.

If the typehead clutch is latching correctly but two letters are struck by the typehammer, readjust the latter in accordance with Section 6 (*b*).

PAPER CARRIAGE UNIT (PAGE) FAULTS.

If the paper is not fed forward regularly for each letter, check the adjustment of the carriage feed and retaining pawls and the crosshead. See Section 24, *a*, *b*, and *e*.

If the carriage does not return at the end of each line, verify that the carriage return combination has been selected, and then verify the adjustment of the following :—

(*a*) Carriage return control lever (Section 2).

(*b*) Carriage return dog (Section 24, *d*).

If the carriage does not feed the paper forward one line when the column signal is transmitted, verify that the selection has been correctly made, and then check the following adjustments :—

(*a*) Column control lever (Section 2).

(*b*) Column dog (Section 24, *d*).

(*c*) Column feed (Section 24, *f*).

If the paper tends to feed towards one side of the unit, check that the pressure of the two pressure rollers on the platen is equal. This can only be corrected by setting the roller pressure springs.

ADJUSTMENTS

Important Note.—Each unit is provided with functional stop screws, the position of each of which is set in the factory. *They should on no account be altered*, except in the case of the position adjustment of the answer-back unit as described in Adjustment, Section 15 (*e*).

1. TYPEHEAD CLUTCH (Fig. 14).

Check dimensions " c " and " d," and correct if necessary by inserting shims as shown.

When the typehead is unlatched and positioned as in Fig. 14, check the pressure of the latch spring at the end of the latch cam, as shown by the arrow. This should be between 2 oz. (57 grs.) and 3 oz. (85 grs.), and may be corrected by slightly setting the latch spring extension.

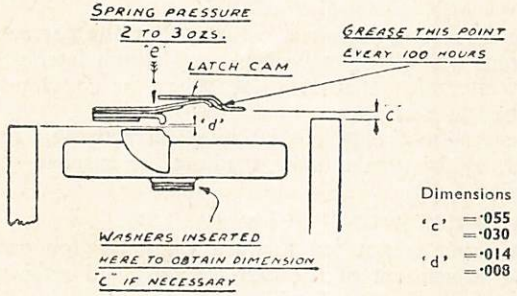


FIG. 14.

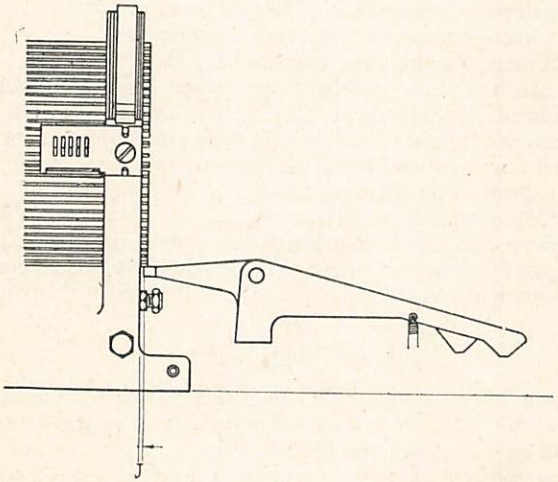


FIG. 15.

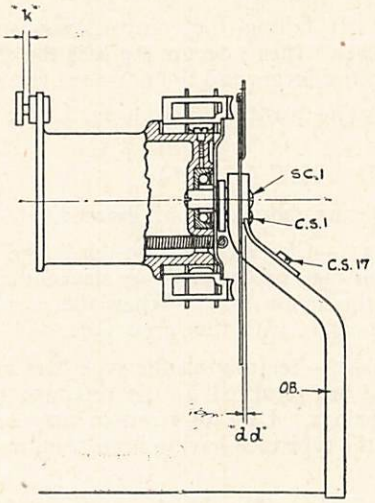


FIG. 16.

Dimensions J $\begin{matrix}=\cdot047''\\=\cdot010''\end{matrix}$ "k" $\begin{matrix}=\cdot010''\\=\cdot005''\end{matrix}$ "dd" $=\cdot002''$

2. CONTROL UNIT (Fig. 15).

Allow the levers to rest against their bellcranks.

The shoe on each control lever should rest approximately centrally on its bellcrank, and clear the combination head front plate by ·047 (1·2 mm.) – ·010 (·25 mm.) dimension J.

The control levers should clear their associated feed dogs by at least ·010" (·25 mm.) when in their normal or unoperated condition.

BUFFER PLATE.—Turn the motor until the bellcranks are fully raised. Adjust the Buffer Plate, after releasing the two fixing screws, to give a ·020 (·51 mm.)"–·030" (·76 mm.) clearance between the underside of the buffer plate and the top edges of the Control Levers. Secure the plate with the fixing screws.

BUFFER SPRING.—Slacken the buffer spring fixing screw and adjust the spring so that the non-feed lever is held clear of the control levers by approximately ·010" (·25 mm.). Now select fingers 2, 3 and 4 and continue turning the motor until the

bellcranks fall. In falling, the control levers should not move the non-feed lever. If this occurs increase the clearance slightly between the control levers and the non-feed lever.

(See also " adjustment *d*, Section 24, Letter Feed Dog.")

3. TYPEHEAD UNIT (Fig. 16).

The ball-bearing should be well greased.

(*a*) END PLAY.—Check dimension " k " (the end play of the typehead). This may be corrected by slackening the screw CS1 and adjusting the screw SC1. When the correct end play is obtained, clamp again with the screw CS1.

(*b*) TYPE BARS.—See that all the type bars are free to move in the rack and are returned by the retaining plate under the action of its springs. Lack of freedom may be due either to the type bar or the type rack having been bent, or to the presence of dirt or grit.

(*c*) BLANK TYPES.—The blank types are fitted to impede the forward movement of the typehammer and so obviate the possibility of the breakage of the type rack, due to the hammer head striking it behind a slot bearing no type. To fit a blank type, the typehead should be removed and the blank type inserted from the rear of the typehead, a slight pressure being exerted to force the heel of the blank type over the back plate of the typehead.

4. RIBBON JUMPER STEADY PLATE (Fig. 16).

The steady plate should satisfy the dimension " dd " for clearance of the ribbon jumper. This may be corrected by slackening the screws CS17, readjusting, and subsequently clamping with the screws CS17.

5. COMBINATION HEAD AND CAM UNIT (Figs. 17–23).

(*a*) PAWLS.—The pawls in the cam should enter the ratchets with a clean, smooth, lively movement under the action of their springs, and independently of one another. Failure to do this may be due to distortion of the pawl springs, or to the accumulation of dirt or grease.

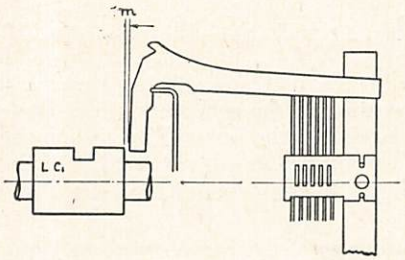


FIG. 17.

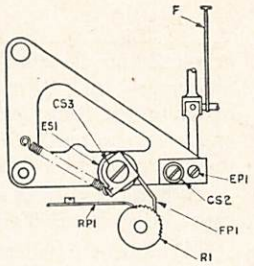


FIG. 18.

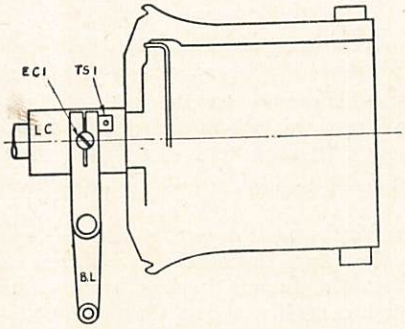


FIG. 19

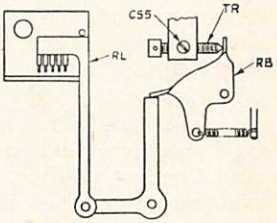


FIG. 20.

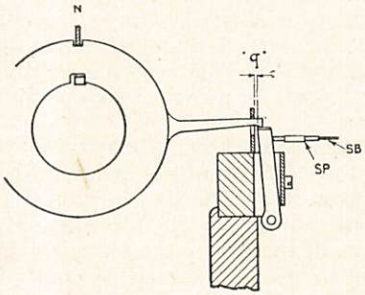


FIG. 21.

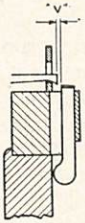


FIG. 22.

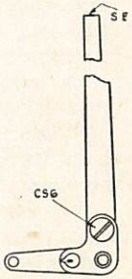


FIG. 23.

Dimensions " m "—$\frac{\cdot 008.}{\cdot 006.}$

" v " = ·017″ minimum. " q "—*see* paragraph " *e*," adjustment 5.

(*b*) BELLCRANK LIFT (Figs. 17 and 19).—Allow the top bellcrank (letter N, combination — — + + —) to fall, and check the clearance " m " (Fig. 17) with the Bellcrank Lifting Lever cam roller on the long, straight portion of the cam track. The clearance may be corrected by slackening the screw TS1 and adjusting eccentric EC1 until the clearance " m " is obtained.

When the correct adjustment has been obtained the screw TS1 must be reclamped tightly.

A modified bellcrank spring was introduced on all machines subsequent to serial No. 5280, to reduce the maximum load on starting should the machine come to rest just prior to the bellcrank lifting position.

The individual tension required to lift each bellcrank, measured at the typehead end, should be $1\frac{1}{2}$–$1\frac{3}{4}$ oz. (43–50 grams).

As a final check that the bellcranks are being lifted sufficiently, turn the cam by hand until the bellcranks are fully lifted. Then lift each comb extension in turn with the spring hook supplied, and they should return snappily under the action of their springs.

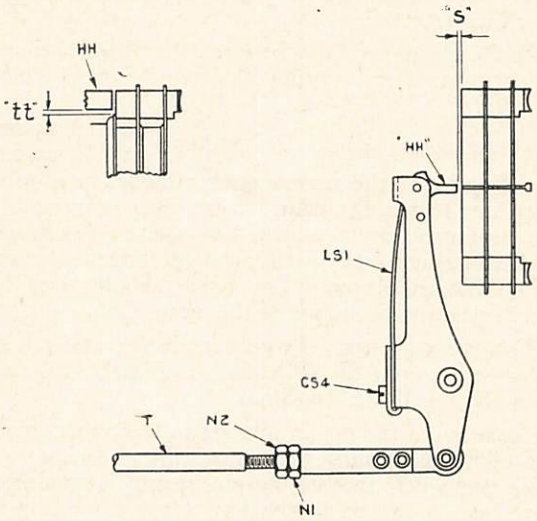
(*c*) FINGER LIFT.—Push the fingers forward to the " Marking " position, and turn the cam until they are lifted to their topmost position. With the fingers in this position the bellcranks should be situated centrally above their respective notches in the combs.

It is not possible to adjust the lift of the fingers satisfactorily while they are fully lifted. Hence if this adjustment requires attention, the cam should first be turned by hand until the fingers are withdrawn. The screw CS2 (Fig. 18) should then be slackened, and the adjustment made by means of the eccentric screw EP1. Reclamp screw CS2.

When the adjustment has been made, it must be checked by again lifting the fingers to the fully lifted position and checking the position of the comb notches in relation to the bellcranks.

(*d*) FINGER SPRINGS.—When a finger spring is placed on a flat surface so that the two ends of the spring are touching the surface the centre of the spring should be between $\frac{1}{16}''$ and $\frac{3}{32}''$ (1·6 mm. and 2·4 mm.) from the surface, and a pressure of from 8 to 10 ozs. (225–285 grams) should be required to depress the centre to $\frac{1}{32}''$ (·8 mm.) of the surface.

(*e*) FINGER SETTING BLADE (HORIZONTAL MOVEMENT).—Move the magnet armature to the " Spacing " position, and commence turning the cam by hand, immediately returning



Dimensions "S" $= \frac{1}{32}''$ for page Teleprinters. "tt" = ·030″
$= \frac{1}{16}''$ for tape Teleprinters. = ·019″

FIG. 24.

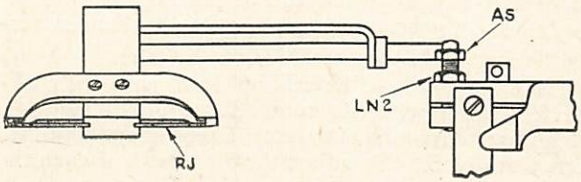


FIG. 25.

the armature to the marking position while continuing to turn the cam. Each finger will be pushed forward into the position shown in Fig. 21.

Check the clearance " q " between the fifth finger and either the stop plate or the re-setting link, whichever is closer to the fingers.

This clearance should be either ·005″ (·13 mm.) ·002″ (·05 mm.) for machines fitted with the narrow setting blade, or approximately ·010″ (·25 mm.) when the wide setting blade is fitted.

This clearance may be adjusted by slackening the screw CS6 (Fig. 23), and altering the position of the finger setting blade in relation to its cam lever. The blade should then be firmly clamped in position by means of the screw CS6.

(*f*) Traversing Link.—Proceed as in (*e*), and note whether the finger setting pin SP (Fig. 21) is central with each finger in turn at the " half-set " position.

The position of the pin in relation to the traversing link may be adjusted by slackening the screw which clamps in position the block on which the setting-pin spring is mounted. The pin may then be moved in relation to the traversing link, and may be securely fixed in its new position, by reclamping the screw. Verify that when the setting pin is pushed forward to its farthest extent it will return freely. If it does not, make sure that it is horizontal and not fouling the edge of the slot in the traversing link.

Failure of the pin to return freely may cause distortion of the fingers and finger block.

(*g*) Finger Resetting.—When the fingers are reset by the resetting link RL (Fig. 20), the dimension " v " (Fig. 22) should be satisfied. To correct this adjustment, slacken screw CS5 (Fig. 20), and adjust the trip screw TR until the finger resetting mechanism is tripped when the dimension " v " (Fig. 22) is satisfied. The fingers must then have a further movement of at least ·005″ (·13 mm.).

(*h*) Ribbon Feed.—The ribbon feed pawl FP1 (Fig. 18) should feed the ratchet R1 round for approximately 1¼ teeth, allowing the retention pawl to retain a feed of one tooth when the set-back takes place. To adjust the feed pawl, slacken the screw CS3 and turn the eccentric sleeve ES1 until the required adjustment is obtained, then re-clamp with the screw CS3.

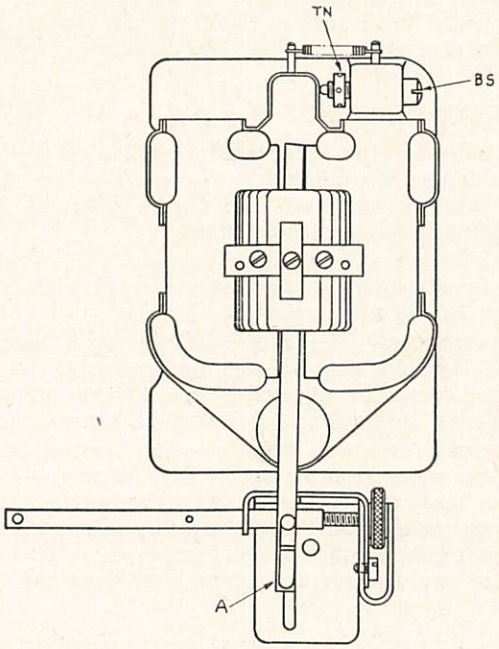


FIG. 26.

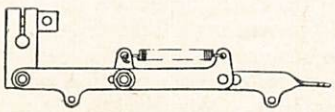


FIG. 27.

(*j*) RECEIVING CAM.—The end play is controlled by the rear bearing screw. It should not exceed ·0015″ (·038 mm.), but the cam must not be clamped between the races.

Care should be taken to re-clamp the rear bearing screw very tightly after any adjustment has been made.

6. TYPEHAMMER UNIT (Fig. 24).

After selecting the letter shift combination (+ + + + +), select the letter N combination (— — + + —) on the fingers, turn the machine by hand until the N bellcrank has fallen, then latch the clutch on this bellcrank.

(*a*) CLEARANCE.—Check the clearance " S." This may be corrected by adjusting the positions of the two nuts N1 and N2. These nuts should subsequently be locked.

(*b*) ALIGNMENT.—The centre of the type hammer head should be correctly aligned with the centre of the type bar. The alignment may be adjusted by releasing the screw CS4 and moving the leaf spring LS1. Reclamp the screw CS4.

(*c*) SHOCK ABSORBER SPRING.—The correct method of adjusting the shock absorber spring is as follows :—

Remove the typehammer from the machine and screw up the typehammer rod T until the spring enclosed in the shackle is closed right up, then release for approximately one turn and replace on the machine. Secure with screw and washer.

7. RIBBON FEED BRACKETS AND RIBBON (Fig. 25).

(*a*) RIBBON JUMPER (7A *Teleprinters*).—The ribbon jumper should raise the ink ribbon sufficiently so that when the type strikes the ribbon, the top edge of the type pad is $\frac{1}{32}$ (·8 mm.) below the top edge of the ribbon when the traversing link is fed to its extreme position.

7B *and* 7C *Teleprinters*.—When the type strikes the ribbon the top edges of the type pad and the ribbon should be level except when long fractional types are used (*e.g.* 7/), when the adjustment should be as for 7A Teleprinters.

To adjust the ribbon lift, turn the cam by hand until the traversing link is in its extreme position of movement towards the back of the machine. Now slacken the nut LN2 and adjust the abutting screw AS until the ribbon is at the required height. Reclamp the nut LN2.

(*b*) FEED CHANGE.—Remove the ribbon spools and see that each feed change rod falls freely into contact with the feed change spindle. When the bobbin spindles are turned by hand, the ribbon driving shaft should alternate between its two positions due to both rods having fallen.

Failure to function correctly may be due to accumulation of dirt or grease round the feed change rods, wear at their lower ends, bending of the rods, or stiffness of the change rod bellcranks.

8. OPERATING MAGNET UNIT (FIG. 26).

(*a*) BIAS.—When the operating magnet link is disconnected, equal force should be required to move the armature from each stop. This may be adjusted by means of the screw BS. The adjustment should be clamped with the nut TN.

(*b*) MAGNET STRENGTH.—With no current in the operating magnet windings and with the link removed, the forces required to move the armature from side to side should be equal. When applied just in front of the armature stop-plate, these forces should be within the limits of 8–12 oz. (225–340 grms.).

These forces can only be changed by replacing or remagnetising the magnets.

The armature travel between stops should be ·022″ to ·025″ (·56–·64 mm.).

9. OPERATING MAGNET LINK (FIG. 27).

Fig. 27 illustrates the original yielding type of link. This has now been replaced by a solid link.

10. FINGER SETTING BLADE (VERTICAL MOVEMENT) Fig. 28.

NOTE.—If it is found necessary to change this adjustment, adjustment No. 12 (below) will also require attention.

To adjust the finger setting blade, move the magnet armature to its spacing position, and commence to turn the cam by hand. Immediately return the armature to its marking position, and continue to turn the cam until the blade SB is just in contact with the setting pin SP in front of the middle finger. The top edge of the blade should now be approximately ·010″ above the centre of the pin, or, in other words, the centre of the blade should be striking across the centre of the pin.

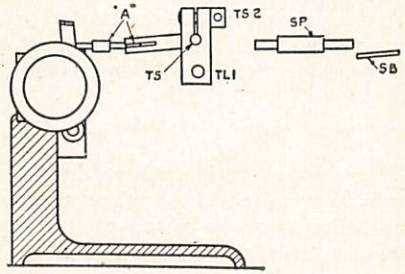


FIG. 28.

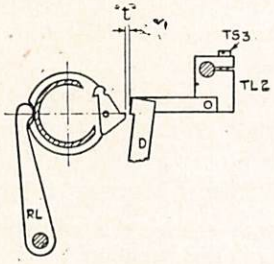


FIG. 29.

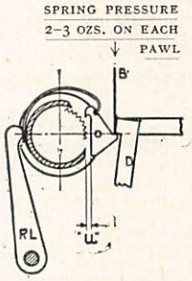


FIG. 30.

Dimensions "t" = ·004″ = ·002″ "u" = ·004″ = ·002″

To adjust the height of the blade in relation to the Finger Setting Pin, slacken the screw TS2 which clamps the tripshaft lever TL1 to the tripshaft TS. Care must be taken that the armature is held to the marking stop while the tripshaft is being reset. When the adjustment is reset, clamp by means of the screw TS2.

If this adjustment is correctly carried out, the blade SB will clear the pin SP if the cam is revolved while the armature is held in the spacing position.

11. FINGER SETTING BLADE (Reaction on Armature for Single or Double Current Operation).

Disconnect the biasing spring, if in use. Then if the operating magnet is adjusted to have no magnetic bias with the tripshaft link disconnected (Adjustment 8(*a*)), it should still require slightly decreased but equal forces to move the armature in each direction when the link is connected.

If these forces are unequal the " Finger Setting, Blade " is exerting unequal marking and spacing reactions on the armature, and a slight set (*not* a twist) must be put in the blade so that the operating magnet is unbiased. The reaction of the blade should not reduce the force required to move the magnet armature by more than 2 oz. (57 grams) in either direction.

The blade should move perfectly freely in the guide with the armature in either position.

Should the blade require resetting at any time the removal of the top guide enables the blade to be lifted straight out. The blade can then be set as required and replaced.

12. DETENT (Fig. 29).

With the armature in the marking position arrest the pawls against the detent. Now, when the armature is moved to the spacing position, there should be a clearance of ·004″–·002″ (·1–·05 mm.) between the pawls and the detent (dimension *t*).

This clearance may be adjusted by inserting a piece of paper between the operating magnet armature and its spacing stop and wedging the armature in its right-hand position, slackening screw TS3, pressing the detent lightly against the pawls and re-clamping screw TS3.

13. RETENTION LEVER (Fig. 30).

Turn the cam until the retention lever RL bottoms in the cam hollow, as shown in Fig. 30, and the detent engages with the pawls. It is essential to verify that the hump of the retention lever is held seating properly in the bottom of the cam hollow.

If a thin blade B is pressed down on the pawl engagement faces, as shown, the force necessary to move each pawl engagement face away from the detent should be between 2 and 3 ozs. (57–85 grams).

The position of the retention lever may be adjusted to obtain dimension " u " by slackening the locking nut and turning its eccentric pivot until the pawls can be pressed away from the detent by approximately ·003″ (·076 mm.) without moving the cam. Re-lock the pivot after adjustment.

14. STARTER SWITCH CONTROL UNIT (Figs. 31–35).

(*a*) STARTER TRIP MECHANISM.—With the starter trip lever KL engaged in the electromagnet link RL (Fig. 31), move the armature so that the spring extension (KS) to the trip lever is in its right-hand position viewed from the front of the machine.

With the weight-arm pin fully engaged in a hole in the worm wheel, see that the end of the trip spindle K (Fig. 33) projects through the support S (Fig. 32) so that it touches but does *not* set the leaf spring LS2.

The spindle may be moved longitudinally by unscrewing the screw CS6 (Fig. 33).

Care should be taken when reclamping to see that the screw is located on the flat provided on the spindle.

Note particularly that the tip of spindle K is not binding on the sides of the clearing hole in the support bracket S, owing to the presence of dirt or grease.

With the weight-arm pin WP (Fig. 33) still engaged in a hole in the worm wheel WW (Fig. 32), and the armature still in its marking position, the dimension " w " (Fig. 32) should be satisfied. This may be adjusted by unscrewing the screw CS7 and sliding the trip boss SB along the spindle.

When the screw CS7 is again clamped in position, care should be taken that its end is located on the flat provided on the spindle.

(*b*) STARTER WEIGHT.—When the weight arm WA is in its " down " position, as shown in Fig. 35, the pin in the weight arm should be clear of the shroud SS but should not fall beyond dead centre.

When the weight arm WA is in its " up " position, the pin in the weight arm should be clear of the shroud SS, and the hole immediately under that in which the pin is resting should just be emerging from behind the shroud as the motor is switched off.

If the switch is breaking too early, the clamping screw CS9 (Fig. 34) should be slackened and the weight arm moved down the rod and reclamped. Screw CS8 (Fig. 34) should then be slackened and the positioning collar C lowered to rest on the top of the weight and reclamped.

If the switch is breaking late the collar must first be moved up a little and the weight raised correspondingly.

After this adjustment has been made, it should be ascertained that with the arm WA (Fig. 35) in its lowest position, the spring extension KS (Fig. 32) will pass freely into the slot in the boss SB (Fig. 32). This may be effected by setting the lever KL 'Fig. 31) slightly by means of a pair of pliers.

The weight-arm pin must fall clear of the shroud SS (Fig. 35) in order that the pin can enter a hole in the worm wheel when one presents itself.

(*c*) FORCE TO TRIP STARTER.—Lift the weight and engage the weight-arm pin WP (Fig. 33) in the hole exposed at the top of the shroud. The force applied at the end of the trip spindle K required to disengage the pin from the worm wheel and so allow the weight to drop should not exceed 3 oz. (85 grams). If the spring be removed, the force should not exceed $\frac{3}{4}$ oz. If a greater force than this is required, it indicates that the trip spindle is not perfectly free in its guides. When the weight is down and the spring fitted, the force required to start the movement should not exceed 1 oz. (28 grams).

The trip spindle should be kept clear of dirt and grease.

15. KEYBOARD (Figs. 36–38).

(*a*) PAWLS.—The pawls in the transmitting cam should enter the ratchets under the action of their springs with a clean, smooth, lively movement, and independently of one another. Failure to do this may be due to accumulation of dirt and grease or distortion of the pawl spring.

(*b*) DETENT CLEARANCE.—Turn the transmitting cam until the pawls F (Fig. 36) are arrested by the detent E (Fig. 37). Depress any key, and check the dimension " b " (Fig. 37).

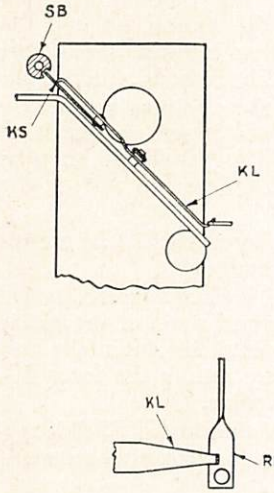


FIG. 31.

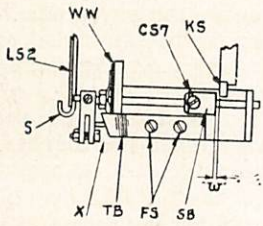


FIG. 32.

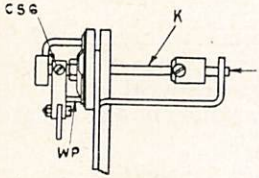


FIG. 33.

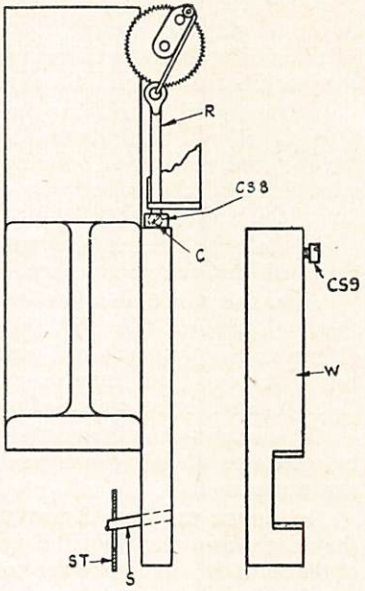


FIG. 34.

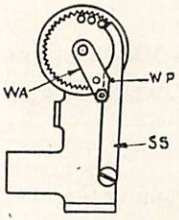


FIG. 35.

Dimensions "w" $= \cdot 010''$
$= \cdot 005''$

Should this be incorrect, it may be adjusted by releasing the screw B, and by means of the eccentric screw C adjusting the trip bellcrank D, so that the detent E is lifted clear of the pawls F to satisfy dimension " b."

(*c*) COMB RESETTING LEVER.—With the motor running, depress any key and check dimension " c " (Fig. 36) for the comb bars and the locking bar in relation to the key depressed.

To correct this adjustment, retain the key depressed, release screw G (Fig. 36), and adjust H (Fig. 37) by means of the tommy-hole in the spindle J (Fig. 38), so that the positions of the comb bars K and the keybar L (Fig. 38) satisfy dimension " c " (Fig. 36).

(*d*) LOCKING BAR, No. 2.—See that when any key is depressed the second locking bar is swung under the ends of the keybars, thus preventing any other key from being depressed until the depressed key has been released.

To correct this adjustment, the locking bar lever clamping screw should be slackened, and the locking bar moved to the required position. The clamping screw should then be securely tightened with the locking bar in its new position.

(*e*) ANSWER-BACK UNIT POSITION.—Should a new set of wards be fitted to the answer-back drum, the clearance " h " (Fig. 38) should be checked.

To do this, arrest the pawls F (Fig. 36) by the detent E (Fig. 37), hold the lever V away from the star wheel W, and turn the answer-back drum so that the wards are brought one by one in front of the comb bars. Clearance " h " (Fig. 38) can then be checked for each ward in turn.

The adjustment may be corrected by slackening the answer-back unit fixing screws and sliding the unit along its keyway until the dimension " h " is obtained. If this is necessary, the functional screws will have to be readjusted.

After reclamping the fixing screws, the abutment screw should be adjusted so that it meets the abutment screw on the keybar unit. Care should be taken that the locknut of the abutment screw is tightened.

16. STRIKER TRANSMITTER (RE-ADJUSTMENT) (Fig. 39).

(See grm./oz. conversion table at end of book.)

1. Depress any key and turn the machine by hand until the striker lever extension A is on the top of its cam and the knife edges of the striker and the transmitting tongue are in line.

Slacken screw B and adjust the clearance between the two knife edges to ·015″ (·38 mm.) This must be adjusted with the striker C bearing against the top edge of the slot in the striker lever D.

2. Select letter shift and turn the machine by hand until two adjacent selector levers E (preferably 1 and 2) are in a common position and touching the insulated edge of the frame F. Insert a ·015″ feeler between the insulated edge of the frame and the two fallen selector levers. Slacken the stop plate fixing screws G and adjust the stop plate H to bear against the right-hand edge of the slot in the striker C. Clamp the stop plate in this position and remove feeler.

3. Slacken the contact clamping screws I and screw up the contact screws J until the transmitting tongue is held with the point of its knife edge in line with the point of the knife edge on the striker. Now unscrew the contact screws ·003″ (·08 mm.) either side of the transmitting tongue K to give ·006″ (·15 mm.) travel.

In this condition the striker should fall equally each side of the transmitting tongue. Should it not do so a further slight adjustment of the contact screws is required, still maintaining the ·006″ (·15 mm.) travel.

4. Slacken the lock nut on screw N and by means of that screw adjust the jockey roller assembly O to such a position that the forces required to move the transmitting tongue from one contact to the other are equal. This should be between 120 and 130 grams, ($4\frac{1}{4}$–$4\frac{1}{2}$ ozs.) measured at the top of the transmitter tongue. Tighten screws.

5. With the striker C at its maximum height the pressure required to lift the striker against the action of its spring P should be between 125 and 155 grams ($4\frac{1}{2}$–$5\frac{1}{2}$ ozs.). This must be measured as near the end of the striker as possible.

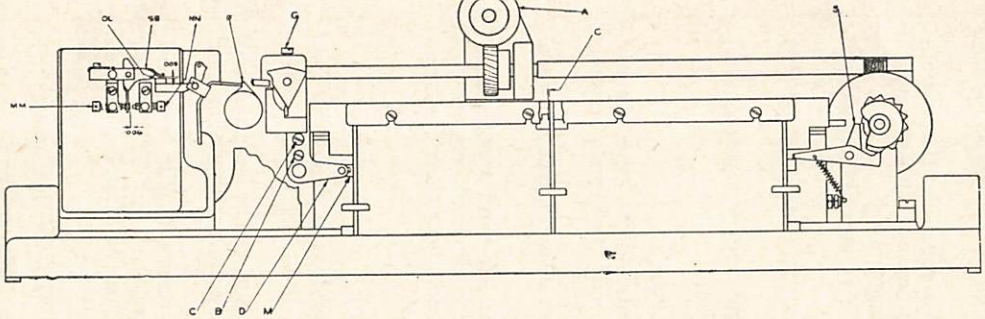
17. SPECIFICATION OF PERFORMANCE OF CORRECTLY ADJUSTED TRANSMITTER.

1. Transit time not more than 0·5 milliseconds.

2. No contact bounce.

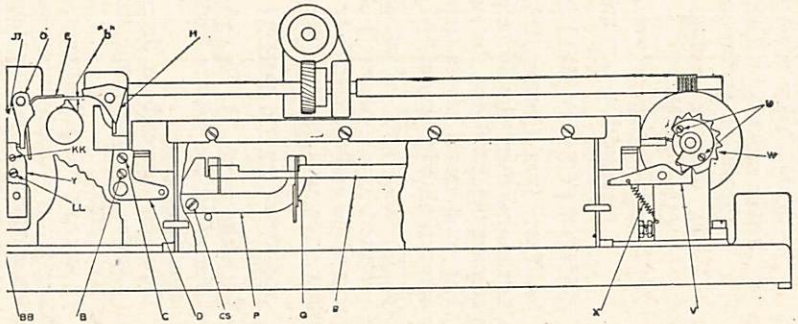
3. Block signals of two or more of the same polarity show no signs of splitting.

4. The distortion of the signals fall within C.C.I.T. specification, *i.e.* the transits are not displaced from their correct theoretical position by more than ± 1 millisecond.



Note.—Clearance between keybars and comb bars, Dimension C = $\begin{matrix}\cdot018''\\\cdot010''\end{matrix}$

FIG. 36.



Dimension b = $\begin{matrix}\cdot010''\\\cdot003''\end{matrix}$

FIG. 37.

5. The performance specified can be obtained with any of the following variations or combination of variations to the adjustments :—

(*a*) Maximum clearance of ·020″ (·5 mm.), and minimum clearance of ·010 (·25″ mm.) between the knife edges of the striker and transmitting tongue.

(*b*) Striker movement biased ·005″ (·13 mm.) either side of theoretical centre line.

Bias pressure spring between 110 and 140 grams ($3\frac{3}{4}$–5 ozs.)

(*d*) Striker spring between 115 and 170 grams (4–6 ozs.) measured at cam end of striker.

18. SEND-RECEIVE SWITCH (Fig. 36).

(*a*) TEST FOR CORRECT ADJUSTMENT.—With the driving motor running there should be a gap of ·003″ (·08 mm.) between the contact blade SB and the switch lever.

The total travel of the send-receive switch blade between the contacts should be ·006″ (·15 mm.).

(*b*) TO RE-ADJUST.—First adjust the left-hand contact until the required ·003″ (·08 mm.) clearance is obtained between the contact blade and the switch lever. Then adjust the right-hand contact screw until the total travel is ·006″ (·15 mm.).

19. ANSWER-BACK DRUM (Fig. 37).

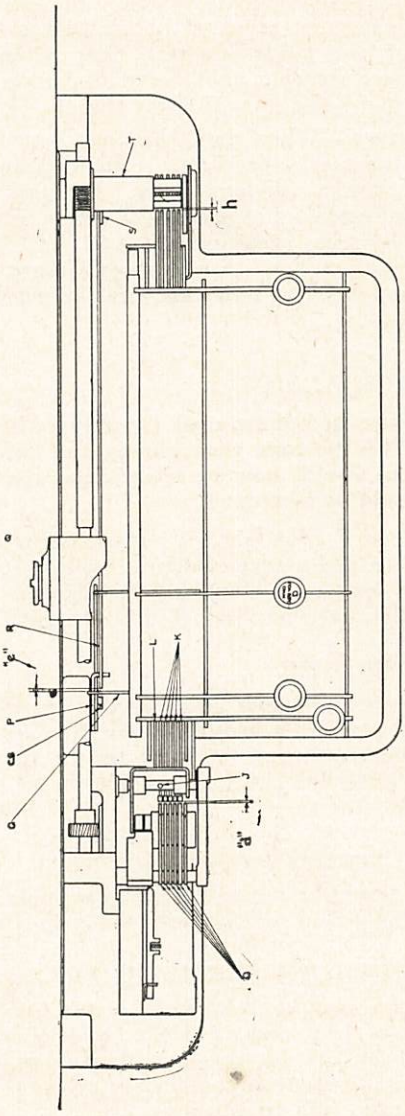
With the pawls F (Fig. 36) arrested by the detent E (Fig. 37), disengage the answer-back detent from the drum so that it is free to rotate.

Turn the answer-back drum in an anti-clockwise direction, and ensure that the comb bars can neither slip under nor over the wards.

To correct this adjustment, slacken screws U (Fig. 37), and holding lever V firmly into a notch, turn the drum T (Fig. 38) slightly in the required direction until this condition is satisfied. Re-tighten screws U.

20. ANSWER-BACK TRIP MECHANISM (Figs. 40–42).

(*a*) KEYBAR EXTENSION.—When the " Who are You " key is depressed, according to its position in the keyboard, its extension should clear either the shoulder or the end of the locking link R by an amount ·006″ (·15 mm.) (dimension " x," Fig. 40).



Dimension d = ·060″ e = ·006″ h = ·020″
·025″ ·010″

FIG. 38.

This clearance may be adjusted by slackening the screw CS10 and moving the guide bracket. Any undue friction between the keybar extension and the guide bracket may be eliminated by setting the keybar extension slightly.

(*b*) RELEASE SHAFT.—When the " Who are You " bellcrank is allowed to fall, the answer-back detent should clear the drum by at least ·010" (·25 mm.) (dimension " y," Fig. 41).

This may be adjusted by means of the screw S2 (Fig. 40), after the lock nut LN3 has been unscrewed.

When the " Who are You " key is normal, there should be a clearance of at least ·010" (25 mm.) between the release shaft Y and the link R (Fig. 40).

21. ANSWER-BACK ALARM.

Rotate the answer-back drum until the plunger P (Fig. 42A) is fully depressed by the cam, then remove the switch cover. The alarm contacts should now be closed, and the clearance " ff " (Fig. 42) should be correct.

When the plunger P (Fig. 42A) is resting on the flat of the cam, there should be a clearance of approximately $\frac{1}{32}$" (·8 mm.) between the alarm contacts. This may be adjusted by means of the screw S3, (Fig. 42) which is locked by the nut LN4.

22. GOVERNOR BRUSHES.

The governor brushes should be set so that, when new, the tip of the back of the governor brush spring is $\frac{3}{4}$" from the motor support plate. The pressure of the brush on the governor will fall as the brush wears, and the spring should be set slightly to compensate for this wear.

23. GOVERNOR (POSITION ON MOTOR SPINDLE).

The governor should be pushed as far as possible on to the motor shaft and clamped in position with the grub screw.

24. PAGE PRINTING ATTACHMENT (FIGS. 43–49).

NOTE.—With the Langitex platens it is very necessary to relieve the pressure of the pressure rollers on the platen when the machine has to be left idle for considerable periods, otherwise irregularities will be formed on the surface of the platen and the feeding of the paper will be impaired.

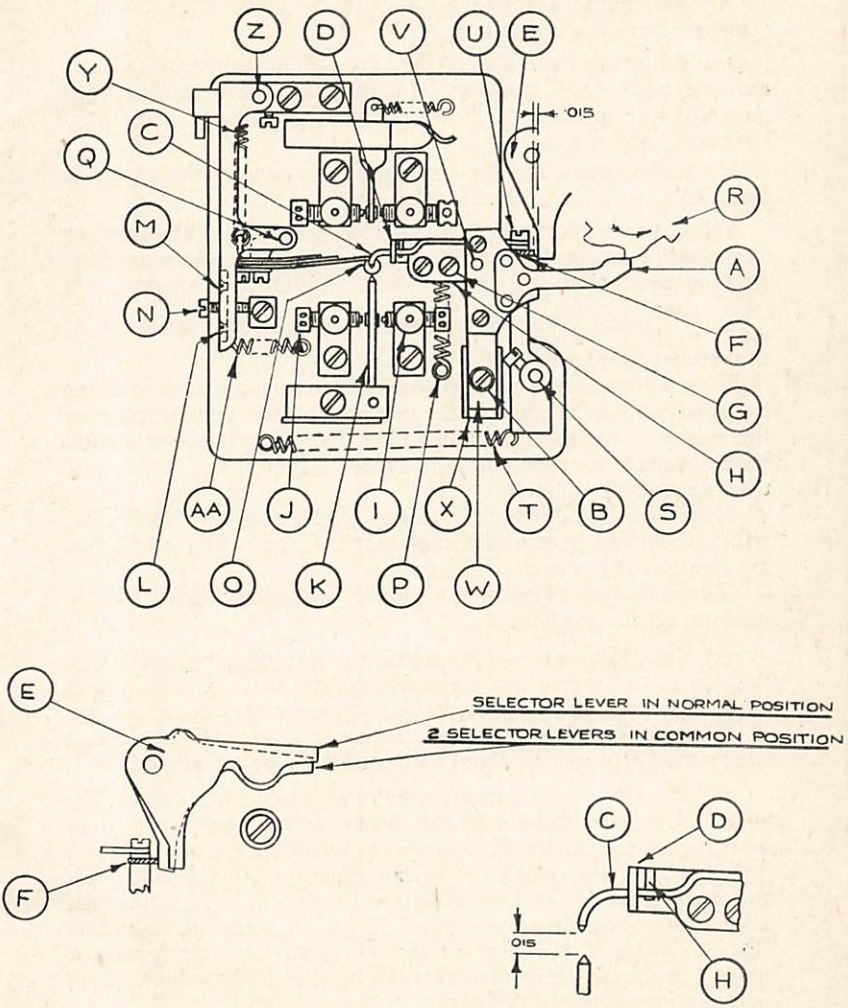

Z
D
V
U
E
Y
C
Q
M
N
.015
R
A
F
G
H
AA
J
I
X
T
B
S
L
O
K
P
W
E
SELECTOR LEVER IN NORMAL POSITION
2 SELECTOR LEVERS IN COMMON POSITION
F
C
D
.015
H

FIG. 39.

The following adjustments should be made with the unit removed from the machine :

(*a*) CARRIAGE FEED PAWL (Fig. 43).—With the carriage in its extreme right-hand position, the clearance between the feed pawl and the next tooth of the ratchet should be at least ·010″ (·26 mm.) dimension " cc ".

The adjustment may be corrected by means of the eccentric pivot EP4, which is locked by the clamping screw CS11.

(*b*) CARRIAGE RETAINING PAWL (Fig. 44).—Feed the carriage along a few spaces to the left. Then with the retaining pawl RP2 engaged with the ratchet there should be a clearance of ·008″ ·005″ ($\frac{\cdot 20}{\cdot 13}$ mm.) between the feed pawl and the next tooth of the ratchet (dimension " dd ").

This adjustment may be checked by turning the machine by hand and ascertaining the position of the typehammer at the moment that the retaining pawl falls. The hammer should have touched the type, but the typepad should not have more than touched the platen.

This may be adjusted by means of the eccentric bush EB1, which is locked by the clamping screw CS12. EB1 and CS12 are situated at the back of the unit.

The following adjustments should be made with the unit in position on the machine :

(*c*) BELL (Fig. 45).—The position of the trigger plate TR in relation to the spring drum should be such that the bell is rung when the carriage is fed 55 teeth (or 55 characters) along the line.

The position of the trigger plate may be adjusted by slackening the screw CS14, which should subsequently be reclamped.

(*d*) COLUMN AND CARRIAGE RETURN DOGS (Fig. 48).—The clearance between the ends of the column and carriage return dogs and the crosshead C should be such as to satisfy the dimension "bb."

To adjust this clearance release the nut N at the back of the casting, and by means of the eccentric pin EP3, adjust the dogs to give the clearance " bb." Lock with nut N. See that the movement of the dogs under the action of their springs is lively. Stiffness of movement may be due to accumulation of dirt and grease round the pivot.

Care should be taken when adjusting eccentric pin EP3 that it is not fouled by the carriage return control lever when the latter is operated.

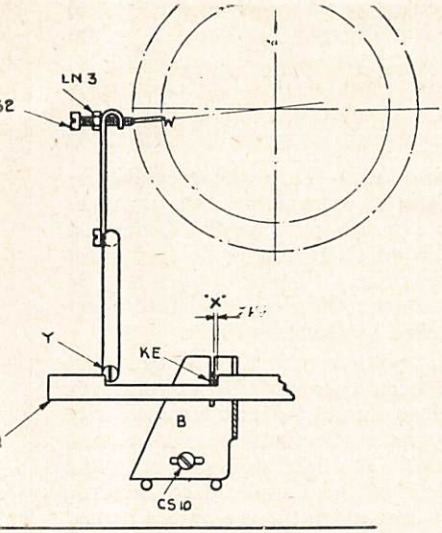


FIG. 40.

Dimensions "x" = ·006"

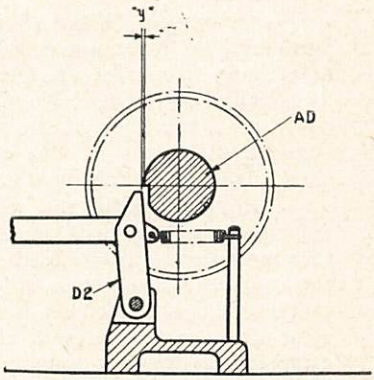


FIG. 41.

"y" = ·010" minimum.

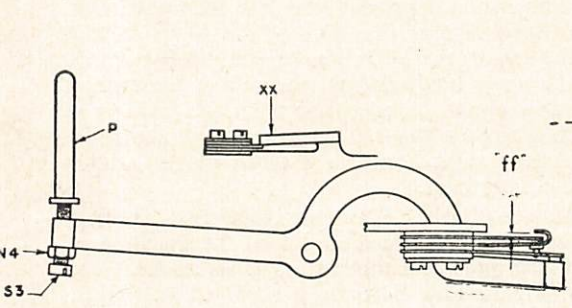


FIG 42.

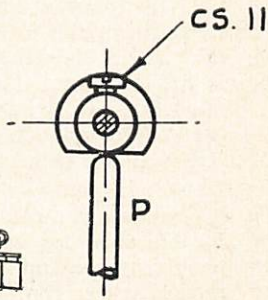


FIG. 42A

Dimension "ff" = $\frac{1}{32}$"

LETTER FEED DOG.—After ensuring that none of the control levers are operated and that the buffer plate and spring on the Control Unit have been adjusted correctly, as specified in Section 2 of these adjustments, position the adjustable plate on the letter feed dog so that there is a clearance of ·006″ (·15 mm.) —·010″ (·25 mm.) between the non-feed lever and the plate.

(*e*) CROSSHEAD (Figs. 48 and 49).—Turn the machine by hand until the traversing link is in its extreme position of movement away from the carriage. In this position the dimension "aa" (Fig. 48) should be satisfied. (This may be seen most easily from the back of the machine.) This clearance may be adjusted by means of the eccentric EC2 on the feed lever (Fig. 49). The eccentric is locked by the screw TS3.

If adjustments (*d*) and (*e*), together with the Control Unit Adjustments (page 45), have been correctly carried out, the carriage return and line feed dogs should be fully engaged with the crosshead when their respective selections are set up, and the machine is turned by hand. The feed dog should at the same time be thrown well clear of the crosshead so that the carriage feed does not operate. Also when the machine is turned by hand, and the following combinations are selected in turn : Bell (Figure shift followed by Bell), Figure Shift, Letter Shift, the feed throw-out mechanism should function correctly.

(*f*) COLUMN FEED (Figs. 46 and 47).—Engage the roller RR with a tooth of the ratchet wheel RW (Fig. 46) so that it beds right home.

Next ascertain that, when depressed, the line feed pawl C.P. slides down the inclined face at the back of the tooth so that the pawl is moved away from the centre of the ratchet wheel. If this condition does not hold, slacken the nut at the rear of nut LN1, Fig. 47, and adjust the eccentric until the pawl is in the correct relationship with the ratchet wheel and the roller RR is at the same time right home in a tooth of the ratchet wheel. Reclamp lock nut LN1.

Now allow the line feed pawl CP to return to normal. Engage the line feed dog with the cross-head and turn the machine by hand until the line feed pawl is at the bottom of its stroke. The ratchet wheel RW should now have been revolved two teeth, and the roller should again just bed home.

To correct this adjustment proceed as follows with the line feed pawl at the bottom of its stroke.

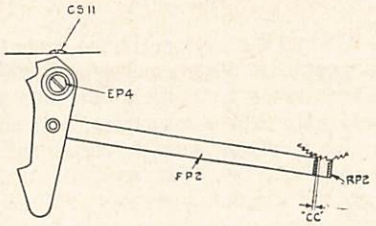


FIG. 43.

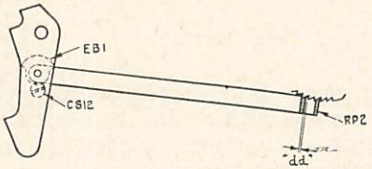


FIG. 44.

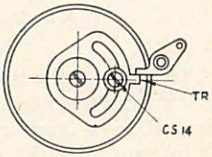


FIG. 45.

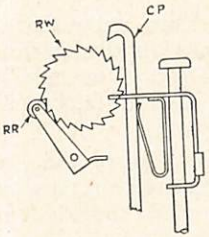


FIG. 46.

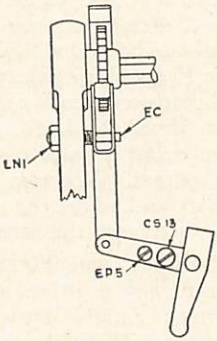


FIG. 47.

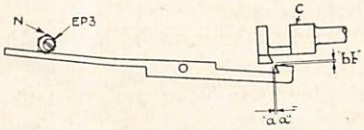


FIG. 48.

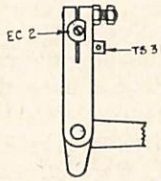


FIG. 49.

Dimensions { "aa" = ·025″ / ·015″ "bb" = ·015″ / ·010″ "cc" = ·010″ min. "dd" = ·008″ / ·005″

Slacken screw CS13 (Fig. 47) and turn eccentric pivot EP5 until the line feed pawl is in such a position that the roller beds-home. Care must be taken to reclamp the line feed pawl retaining plate nut after the above adjustment has been made.

Re-engage the line feed dog with the crosshead and turn the machine by hand until the line feed pawl is at the bottom of its stroke. Slacken the clamping screws of the line feed pawl stop plate and push the plate hard against the feed pawl. Tighten the clamping screws.

Column Feed for Sprocket Feed Carriage.

A similar adjustment to that given above should be made, but it is necessary to ensure that the roller RR retains the ratchet wheel RW in such a position that when typing is effected it will line up with the printed matter on the forms.

(*g*) LATCH (Figs. 50 and 51).—When the unit is latched in position, it should not be possible to unlatch it by pressure on the right-hand end without first disengaging the latch. There should be $\frac{1}{8}$" (3·2 mm.) clearance between the type faces and the platen (dimension " ee," Fig. 51).

To re-adjust the latch, release the clamp screw CS15, and adjust the eccentric sleeve which it secures until the clearance " ee " is correct. Reclamp the screw CS15. Now release the screw CS16, and adjust the upper sleeve until the latch functions correctly. Reclamp the screw CS16.

(*h*) CARRIAGE AIR PISTON (Fig. 50). — Move the carriage to its extreme left position, and press the carriage return button. The carriage should return smoothly and should complete its movement without shock.

The air cushion which determines the damping at the end of the carriage movement may be adjusted by slackening the screw NN (Fig. 50) at the right-hand end of the platen spindle, and turning the valve plate OO about its centre.

The knob at the end of the platen spindle must be removed to gain access to the screw NN.

(*i*) CHARIOT RAIL.—The chariot rail should be so adjusted that, after slackening its fixing screws, the chariot is free in all positions without undue shake.

When the carriage is in its extreme right-hand position, the flat spring at the right-hand end of the chariot should be lightly in contact with the chariot rail.

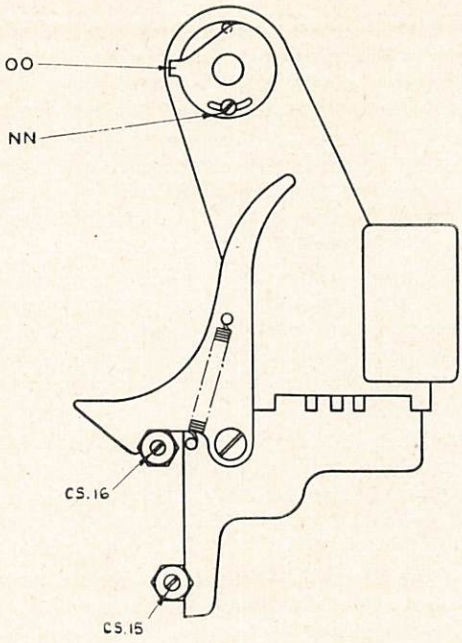


FIG. 50.

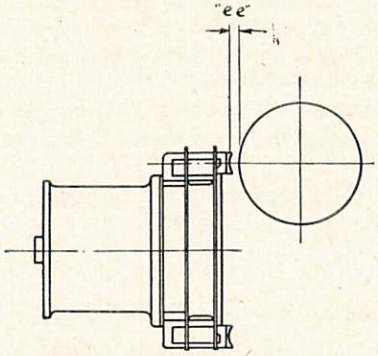


FIG. 51.
Dimension "ee" = $\frac{1}{8}$"

25. TAPE PRINTING ATTACHMENT (Fig. 52).

(*a*) PLATEN.—The pressure of the platen spindle against the feed roller eccentric (4) should be 2–4 ozs. (55–110 grams). A set put in the platen spring will correct the end thrust pressure.

(*b*) PRESSURE ROLLER.—A pressure of $3\frac{1}{2}$–4 lb. (1·6–1·8 kg.) applied at a point on the pressure roller arm above the spring 23 should just move the pressure roller away from the knurled roller at the top of its driving shaft (4). If this is incorrect, the spring (23) should be replaced.

(*c*) PAPER GUIDE.—The paper guide (24) should be sufficiently close to the feed roller (4) to prevent the paper from getting between these two parts. The adjustment may be tested by holding the paper about 1″ (25 mm.) from (4) and revolving (4). If the tape gets behind the paper guide (24), then (24) is not sufficiently close to (4).

(*d*) PLATEN FEED ROLLER SPRING.—The tension of the spring (19) on the spindle should be 1–2 ozs. (28–56 grams). If this tension is incorrect the spring should be replaced.

Turn the knob (4) and see that the platen revolves while moving to and fro under the action of the eccentric.

(*e*) FEED LINK SPRINGS.—Spring (32) should impart an end thrust of 4–6 ozs. (110–165 grams) to the feed link, and spring (33) should have a tension of 2–3 ozs. (56–84 grams). If these tensions are incorrect the springs should be replaced.

(*f*) FEED AND RETAINING PAWL SPRINGS.—The feed pawl spring should have a tension of 1–2 ozs. (28–56 grams), and the retaining pawl spring 1–$1\frac{1}{4}$ lb. (·45–·57 kg.). If these tensions are incorrect the springs should be replaced.

(*g*) LATCH SPRING.—The spring (38) should give a pressure of 15–20 ozs. (·43–·57 kg.), measured at the latching point on the latch.

(*h*) LATCH ADJUSTMENTS.—The adjustments of the latch should be the same as for the Page Printing Attachment (*see* Adjustment 24 (*g*)).

26. END-OF-LINE WARNING SWITCH (Figs. 52 and 53).

(*a*) GEAR WHEEL.—See that the gear wheel (47) will rise and fall freely under the action of the lever (13) (Fig. 53). A pressure of 2–3 ozs. (56–84 grams) on the end of the lever (13) should

lift the wheel (47) out of engagement with the rack Lack of freedom of movement may be due to distortion of the spring (48) or the accumulation of dirt round the spindle.

(*b*) ENGAGEMENT OF RACK WITH GEAR WHEEL.—The wheel (47) must either fall cleanly into engagement with a tooth on the rack when the rack is in its returned position, or it must rest upon the top of a tooth, so that after the spindle (4) has been rotated through a distance equal to one feeding operation, the wheel (47) will fall cleanly into engagement with the rack.

When the spindle (4) is fed through 55–56 letter positions after a carriage return signal, the switch contacts should close.

(*c*) CARRIAGE RETURN MOVEMENT.—Turn the spindle (4) until the rack is in its extreme left position. The operation of lever (13) (Fig. 53) should cause the rack to move smoothly to its position of rest.

Failure to return may be due to the presence of dirt or grease on the guides, or incorrect tension of the spring (49). The spring (49) should exert a force of $1\frac{1}{4}$–$1\frac{3}{4}$ ozs. (35–50 grams) on the rack, and should be replaced if this tension is incorrect.

27. TESTS AND ADJUSTMENTS TO BE CARRIED OUT WHILE MACHINE IS RUNNING.

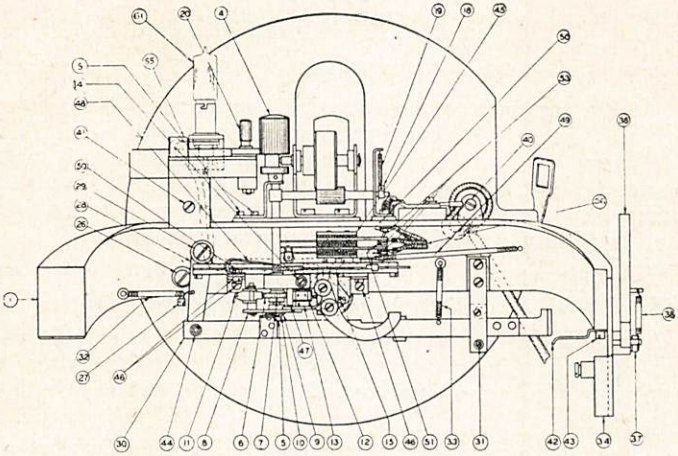
(*a*) ANSWER-BACK TRIP MECHANISM.—With the motor running, after depressing the figure shift key, depress the " Who are You " key and hold it down for at least one second. The answer-back drum should *not* be released when the " Who are You " bellcrank falls (for correct adjustment *see* 20 (*a*)).

(*b*) STARTER THROW-OUT BRACKET.—Allow the weight to operate the switch, and set the motor running. When it has switched off, the beginning of the cam face of the throw-out bracket TB (Fig. 32) should be just clear of the head of the screw in the weight-lifting arm.

This may be adjusted by slackening the screws which secure the bracket and moving it into the required position. Lock in this position with the fixing screws.

To test this adjustment proceed as follows :

Remove the switch cover, then short circuit the motor contact blades, thus making the switch inoperative, and see that as the weight-lifting arm rises, the head of the screw in the weight-



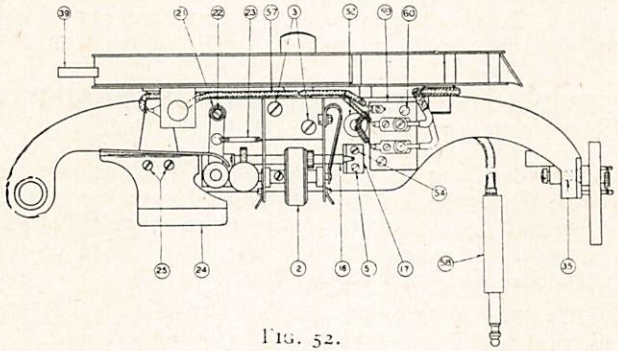


FIG. 52.

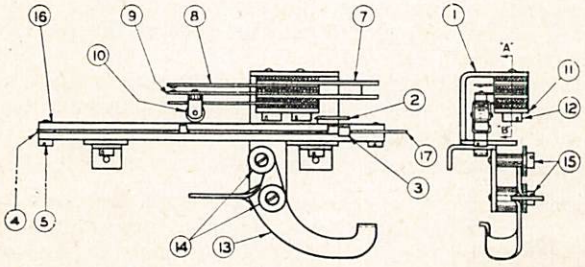


FIG. 53.

lifting arm encounters the cam face of the throw-out bracket and disengages the weight-arm pin from the worm wheel and allows the weight to drop. This must occur before the weight is brought hard up against the switch stop plate and jams. Replace the switch cover.

(*c*) RECEIVING CAM DETENT.—Move the operating magnet armature to the marking side, and with the motor running, *carefully* lift the armature link off the armature and see that the force required to disengage the pawls does not exceed 1 oz. (*See* Adjustments 11, 12 and 13.)

(*d*) TORQUE TRANSMITTED BY TYPE CLUTCH.—See that at normal speed, *i.e.* 643 r.p.m., the clutch force measured at the typehead barrel locating pins, with the clutch unlatched, is not less than $3\frac{1}{2}$ lb.

If the pressure is incorrect, dismantle the clutch and treat as specified in lubrication chart. (Page 87).

DISMANTLING AND REASSEMBLING INSTRUCTIONS

DISMANTLING INSTRUCTIONS

(See Fig. 54)

DO NOT TOUCH THE ABUTMENT SCREWS

1. Remove the carriage by pressing on the latch and lifting the carriage clear of its pivot.

2. Remove the keyboard and coupling disc, after withdrawing the two fixing screws.

3. Turn the Safety Catch of the Control Lever Unit " D," under the Feed Throwout Lever. This lifts the control levers clear of the bellcranks in the Combination Head.

4. Remove the units on the Main Base in the following order :

4·1. Operating Magnet Unit K.

4·2. Biasing Unit L.

4·3. Ribbon Feed Brackets, H and J, complete with ribbon.

(*Note.*—If either of these brackets is removed without the ribbon, either an empty spool reel should be placed in position or great care should be taken to ensure that the small bellcrank, normally held in by the ribbon, is held in by the fingers, thus preventing the feed change rod from slipping down as the feed bracket is lifted, and getting caught and bent.)

4·4. Typehead Support Bracket E (after removing the fixing screw, hold the bracket each side of the fixing screw hole and tap the ball race lightly with the handle of the screwdriver. Lift the bracket clear, disengaging it from the ribbon jumper).

4·5. Typehead Unit C.

4·6. Covers, X and Y.

4·7. Screw, securing mainshaft R to Cam Unit F.

4·8. Starter Weight Guide.

4·9. Fixing Screws of Starter Switch Control Unit M. (To remove the front screw, raise the Weight by means of weight-lifting arm.)

4·10. Slacken the screw securing the starter weight to the weight lifting rod.

4·11. Lift Mainshaft, coupling disc and starter switch control unit clear of the machine.

(*Note.*—Do NOT, unless absolutely necessary, remove the starter switch stop plate, or the switch spring stirrup may jump out of engagement.)

4·12. Typehammer Unit G.

4·13. Control Lever Unit D.

4·14. Cam Unit F (after throwing the ribbon feed pawl clear of the ratchet wheel).

4·15. Answer-Back Rockshaft Spring (NOT the Rockshaft).

4·16. Combination Head Unit B (carefully disengaging the Rockshaft from its front bearing).

4·17. Governor Unit O.

4·18. Motor Unit N, complete with End Support Plate P.

(*Note.*—Care must be taken when removing the motor and when the motor is away from the base, that the Governor Brushes are not broken off their leaf springs.)

It is not normally necessary to remove any other items from the base. In this condition, the machine can be thoroughly cleaned and any individual unit dismantled.

It should be noted that the Combination Head, Control Lever and Cam units are each provided with abutment screws, clamped in position by lock nuts. These must NEVER be slackened nor the screws adjusted. These screws are set to gauge in the factory and once they have been moved there is no means of readjusting them correctly without returning the unit to the makers.

RE-ASSEMBLING THE MACHINE.

When re-assembling the machine, reverse the order in which the machine was dismantled.

It should be noted that the Combination unit B is the master unit and is steady-pinned in position. The Cam and Control Lever units are located by means of this unit. When re-assembled, ALL abutment screws must be touching their fellows, and the Cam unit casting the rear bearing block of the Combination Head.

Further, NO clamping screw should be tightened unless the unit it is securing is seated firmly and squarely on the base. If a screw is felt to give, it is indicative that the unit is not seating correctly.

REMOVAL OF INDIVIDUAL UNITS.

Most of the units can be removed individually, such as the Operating Magnet K, Ink Ribbon Brackets H and J, Biasing unit L, Typehammer unit G, Starter Switch control and Mainshalf M and R, Motor N and Governor O.

To remove the Control Lever Unit, the Typehammer unit and the typehead front bearing bracket must first be removed.

The Cam unit F can be removed after removing the Typehammer unit G, Ribbon Feed bracket H, the fixing screw of the Mainshaft L.H. bearing and after slackening the fixing screws of the Starter switch Control unit M. The ribbon feed pawl must first be swung into a raised position.

The Combination Head can be removed without its casting after removing the Typehammer unit G ; the Typehead unit C, complete with front bearing ; the gear covers ; the cam lever plate ; bell-crank lifting lever, complete with cam roller ; and the fixing screw of the mainshaft L.H. bearing. The fixing screws of the Starter Switch Control unit and the Combination Head rear bearing block should be slackened and the steady pin removed from the latter.

If now the rear bearing screw is removed completely, together with the fixing screws for the body clamp strap, the Combination Head sub C.P. can be lifted clear of the casting.

DISMANTLING THE UNITS.

When dismantling and re-assembling the units, the following points should be noted :

CAM UNIT.

The pawls should be perfectly free and lively in action and the pawl spring pin seating well home. The cam should have no end play and should be lightly gripped between the end bearings. No cam rollers should have any tight spots in the tracks.

COMBINATION HEAD.

When dismantling this unit, it is advisable to lay out the bellcranks in the order in which they are assembled in the head, taking special note that certain bellcranks and slots are marked as follows :

Control bellcrank, marked O, associated slot marked *.
Dummy control bellcrank, marked Z, associated slot marked Z.

The two springs, one above and one below the comb extensions, are stronger than the remainder and should be kept separate. The others are interchangeable.

The position of the various distance rings between the combs, etc., should be noted and the rings replaced correctly.

The combination head is dismantled from the rear end, in the following order : gear, bearing block complete with race, bellcrank lifting collar, bellcrank bearing, secured by three fixing screws followed by the racks, distance collars and combination discs. It should be noted that the combination discs, *with extensions*, are numbered, No. 1 being the *first* to be removed and therefore the last to be re-assembled.

The typehead shaft can be tapped out complete with typehead clutch. Care must be taken, when re-assembling, to ensure that the front race is driven home squarely and fully, and that the steady pin in the rear bearing engages with the groove in the body casting.

When re-assembling the head, the marked bellcranks should be assembled first in their respective slots and their springs fitted, followed by the remainder of the bellcranks. So as to distribute the load, it is advisable to space each spring assembled by 90° from the previous one. When re-assembled, all bellcranks must be absolutely free.

OPERATING MAGNET.

It is inadvisable to remove the magnets and this should be done as infrequently as possible.

The coils and armature are removed together, after removing the armature top bearing.

CONTROL LEVER UNIT.

This unit rarely needs to be dismantled, even for cleaning purposes.

MOTOR UNIT.

Do not dismantle this unit more than is absolutely necessary, but keep the commutator clean and in good condition. Replace the brushes when excessively worn.

GOVERNOR UNIT.

Do not dismantle unless necessary ; only clean the contact faces.

INK RIBBON BRACKETS.

These can be dismantled after removing the spring clip at the base of the spindle.

CARRIAGE.

The carriage should be dismantled in the following manner :

1. Slide the carriage to the extreme L.H. end.
2. Remove the Platen Knob.
3. Remove the R.H. end bearing fixing screw and tap the bearing clear of its steady pin hole.
4. Remove R.H. end bearing.
5. Holding the platen firmly, depress the carriage return key at the L.H. end of the carriage and allow the platen to return to the extreme R.H. end without permitting it to come clear of the spring drum.
6. Disengage the chariot from the rail.
7. Remove the spring from the jockey roller lever.
8. After ensuring that the trip bellcrank is clear of the pawl throw-out lever and that the pawls are engaged in the teeth of the ratchet wheel, lift the platen, complete with chariot and spindle, clear of the carriage.
9. Then, holding the spring drum firmly, again depress the carriage return key and allow the spring drum to unwind slowly, counting the number of complete turns that it makes. Note this number on the face of the drum.

The method of dismantling the remainder of the unit is self-apparent.

When re-assembling the carriage, wind up the spring drum the number of complete turns that were noted when the carriage was dismantled. Finish winding when the back or retaining pawl is resting on the *L.H.* end of the blank tooth. This is

most important. Slide the platen right on to the piston. Insert the L.H. bearing into its race and re-engage the rack with the spring drum and the platen with the track rail, ensuring that the platen does not slide along the spindle, the L.H. bearing does not come away from the race, nor the trip bellcrank foul the platen casting.

Then slide the platen to the extreme L.H. end, thus winding up the spring drum, and ensure that the rack does not jump a tooth. It should then be found that the feed pawl (front) is now resting on the blank tooth, and if the crosshead is moved to the right, the feed pawl will slide on the blank tooth and fail to move the carriage.

If this condition is satisfied, replace the R.H. bearing and the remainder of the items removed.

KEYBOARD.

The method of dismantling this unit is mainly self-evident. The transmitting unit should be removed complete after extracting the two fixing screws. The answer-back unit can be removed in the same manner.

The keyboard rarely needs to be dismantled, but if this is necessary, care should be taken to ensure that the springs beneath the keybars are not damaged.

When dismantling the transmitter unit, the Transmitting Head shown in Fig. 39 should be removed as a unit. The front plate is secured by screws and is steady pinned to the bottom front edge of the casting. When replacing this part, ensure that all pivots and pins are fully engaged before inserting the screws.

ADJUSTMENT OF ASSEMBLED MACHINE.

When completely re-assembled, check all relevant adjustments given in the adjustment section of this booklet.

The following table gives the Metric Equivalents of the dimensions given in the preceding diagrams :

Inches.	Millimetres.	Inches.	Millimetres.
·001	·03	·020	·51
·002	·05	·025	·64
·003	·08	·030	·76
·004	·10	·044	1·12
·005	·13	·047	1.20
·006	·15		
·007	·18	·055	1·4
·008	·20	·060	1·5
·009	·23	·408	10·36
·010	·25	·430	10·92
·012	·31		
·014	·36	1/64	·4
·015	·38	1/32	·8
·017	·43	1/16	1·6
·018	·46	5/64	2·0
·019	·48	1/8	3·2

Grammes.	Ounces.	Grammes.	Ounces.
110	3·8	130	4·6
115	4·1	140	4·9
120	4·25	155	5·5
125	4·4	170	6·0

No. 7 AND 8 TELEPRINTER SPRING TENSIONS.

The following table shows the correct tension of all No. 7 and 8 Teleprinter Springs which require accurate setting.

Reference is made to Part List No. 1078 (6th Edition).

Index Letter.	Fig. No.	Spring No.	Remarks.
AD	8 8	PG.2016 PG.2014	The pressure to move the ribbon feed spindle in either direction should be $\frac{3}{4}$–1 lb.
AE	8	PG.2015A	Pressure $3\frac{1}{2}$–$4\frac{1}{2}$ ozs.
On AP	7	PG.5009	Pressure applied at end of switch arm to move it " on and off," $3\frac{1}{2}$–$4\frac{1}{2}$ ozs.
On D	10	PG.3004	3 ozs. applied to end of weight-lifting arm spindle should permit weight to fall.
On AD	13	PG.3009	2–3 ozs. applied near end to move jockey lever from side to side.
T	14	PG.7105 " " " " " " PG.7120	Pressure applied at shoe end to move lever should be :— Erase lever .. .. 10–11 ozs. Column Feed Lever .. 12–13 ozs. Bell Lever .. .. 12–13 ozs. Carriage Return Lever .. 12–13 ozs. Combined Carriage Return and Column Feed Lever, $1\frac{1}{2}$–$1\frac{3}{4}$ lbs.
X	15	PG.7034	Pressure applied at shoe end to move feed, throw-out lever not to be more than $\frac{1}{3}$ oz. or less than $\frac{1}{4}$ oz.
AD	14	PG.7229 " "	Pressure applied at shoe end to move :— Letter shift lever, 9–10 ozs. Figure shift lever. 12–13 ozs.
On R	16	PG.3027B	It should require 2–3 ozs. to push pawls backwards against the cam.
On G	16 and 17	1830/15	Pressure to move shock absorber spring away from head of screw, 8–10 lbs.

Suitable spring balances for measuring these pressures can be obtained from CREED & Co. LTD. under Catalogue numbers 1285/84 (0–12 ozs.) and 1285/35 (0–4 lbs.).

Index Letter.	Fig. No.	Spring No.	Remarks.
On W	16 & 17	PG.2029	7–8 ozs. applied to centre of spring to bring spring $\frac{1}{32}$" out of flat.
L	17	PG.7042	Pressure of retention lever against cam to be $\frac{7}{8}$–$1\frac{1}{8}$ lbs. measured at top of lever.
G	18	1828/19	Spring to compress when 10–12 ozs. is applied to crown wheel.
AA	20	PG.7046	A pull of $1\frac{1}{2}$ lbs. should lift ratchet-wheel roller.
AE	21	PG.7043	With the letter feed dog depressed a pressure of 15–17 ozs. applied at the mouth of the slot should move the cross head.
AH	21	PG.7093	Force applied at end of letter feed link to move it should be 7 ozs. Force applied at end of either carriage return or column link to move it should be 1 lb.
AP	21	PG.7167	4–5 ozs. applied at drum end of pawl should lift it off the spring drum.
On AS	21	PG.1503	With the paper carriage in its extreme left-hand position, the spring should exert a force of approx. 3 lbs., this pressure decreasing to approx. $2\frac{3}{4}$ lbs. in the middle of the carriage travel and approx. $2\frac{1}{4}$ lbs. at the end of the travel
BF	21	PG.7034	$\frac{3}{4}$ oz. applied vertically under the left-hand end of the trip bellcrank should commence to move it.
On BG	21	PG.2011	A force of 1 to $1\frac{1}{4}$ ozs. applied where the dogs are engaged by the control levers should move the former.
On AF	21	PG.2012 / PG.2074	
On AW	21	PG.3010	$2\frac{1}{2}$ ozs. applied to the nose of the line feed pawl B.N. should lift it from the ratchet wheel.

Suitable spring balances for measuring these pressures can be obtained from CREED & Co. LTD., under Catalogue numbers 1285/84 (0–12 ozs.) and 1285/35 (0–4 lbs.).

Index Letter.	Fig. No.	Spring No.	Remarks.
R	22	1839/11A	1¾–2¼ lb. applied to pressure-release lever AA should move pressure rollers from platen.
O	23	PG.7055	Should apply an end thrust of 1–2 ozs. on Platen C.P.
R	23	PG.7099	1–1¼ lbs. measured at roller of retention lever.
Y	23	PG.7039	1–2 ozs. measured at ear of pawl.
With Z	23	PG.7104	3½–4 lbs. measured on the pressure-lever knob.
AC	23	PG.7115	–3 ozs. measured immediately under spring.
AG	23	PG.7102	4–6 ozs. measured at end of link.
J	26	PG.7051	3½–4½ ozs. applied to end of comb bar to move it.
AD	26	PG.7118	Force required to extend from normal position ½–¾ ozs.
With G	26	PG.7121	4–5 ozs. applied at end of locking bar should move it.
On BE	27	PG.7204	*See* adjustment 4; page 59.
BL	27	PG.7205	*See* adjustment 5; page 59.
With Q	27	PG.7094	6–8 ozs. applied at the thin end of selector.
BS	27	PG.7093	1½–2 ozs. applied at top end of lever should move it.
AB	27	PG.7039	½–¾ oz. applied upwards to lift detent clear of pawls.
On F	27	PG.3022	3–4 ozs. to push pawl backwards, so that it just touches the cam seating face.
OA	34	PG.7154	Tension 6–8 ozs.
PB	31	PG.7041	¾–1¾ lbs. required to release detent when the machine is running

Suitable spring balances for measuring these pressures can be obtained from CREED & Co. LTD., under Catalogue numbers 1285/84 (0–12 ozs.) and 1285/35 (0–4 lbs.).

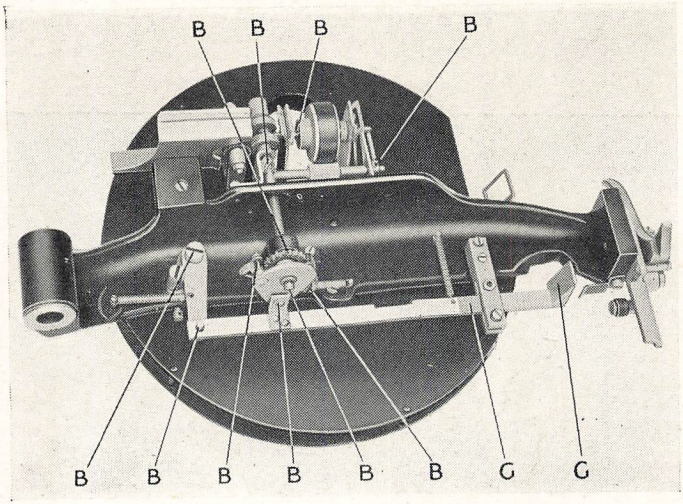


FIG. 55.

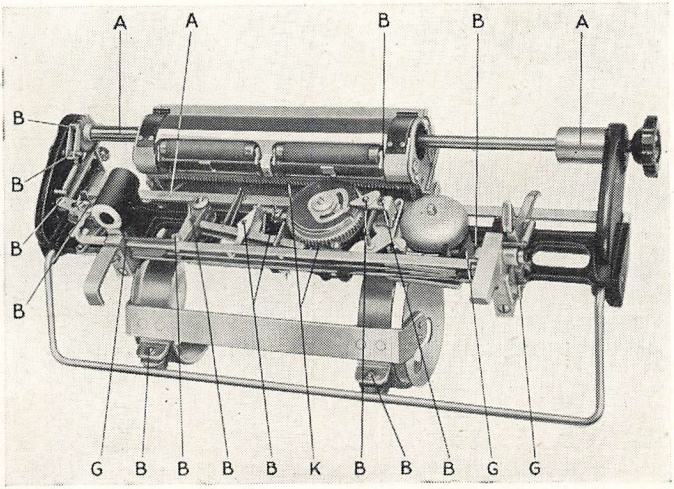


FIG. 56.

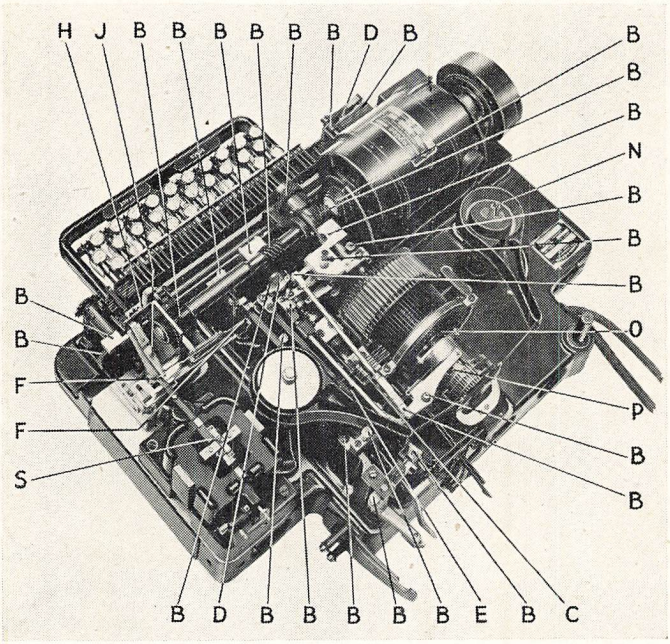


FIG. 57.

LUBRICATION CHART

WARNING : Do not over-oil. Superfluous oil will make the machine dirty and is liable to damage the wiring.

After every 50 hours operation :

Lubricate the bearing surfaces for the platen tube in the end plates of the Paper Carriage unit with a few drops of Lubricant No. 2.

After every 100 hours operation :

A. Clean the Platen Spindle, Air Piston and Running Bar with a rag dipped in paraffin oil, and apply a few drops of No. 1 Lubricant to the spindle and running bar, but not to the piston.

Apply a few drops of No. 2 Lubricant to the following parts :—

B. All oil cups, oil holes, gears, cam rollers, steel couplings and pivots, giving attention to the keyboard trip bar, cam thrust washer, locking bar pivots, ribbon feed mechanism and the Ribbon Feed Jumper Plate and associated groove in the Typehead Support bracket. The felt in the oil container on the cam unit should be saturated with No. 2 Lubricant.

C. Selecting fingers and finger guide pin.

D. Transmitting and receiving cam grooves and pawls.

E. Finger setting blade guides and finger setting pin.

F. Operating magnet link pivots.

G. Printing attachment crosshead, link guide and various friction points, including the Feed Dog, Ratchet and Feed Pawls. Care must be taken to avoid over-oiling these parts as an excess of oil is liable to cause some sluggishness in the operation of the carriage.

Also apply a drop of No. 1 Lubricant to the following parts :—

H. Starter trip spindle.

J. Starter trip lever pivot.

And a small quantity of No. 4 Lubricant to the following :—

K. Platen rack and spring drum gear. The bearing surface between the typehammer head and its associated leaf spring.

N. Apply a small quantity of No. 1 Lubricant to the ribbon feed change rods. Excessive lubrication may cause sticking.

O. Apply a small quantity of No. 5 Lubricant between the latch spring and the latch cam on the Typehead Clutch. See FIG. 14.

P. Grease the Typehead Clutch spindle with the grease gun filled with No. 4 Lubricant.

Q. Smear the knife edges of the Striker Lever and Transmitter Tongue with Lubricant No. 5.

NOTE : Items O, P and Q require special attention, and the instructions should be strictly adhered to.

After every 200 hours operation :

Lubricate the Typehead Clutch lining with a maximum of 6 drops of Lubricant No. 2 and when necessary remove the clutch springs to enable any surplus grease to be cleaned from the linings.

Apply a small quantity of Lubricant No. 4 to the tripshaft cone pivots.

Lubricate the "Shock Absorber" spring in the typehammer unit with a small quantity of Lubricant No. 4.

After every 1000 hours operation :

Dismantle and thoroughly clean and overhaul the machine. Repack all ball bearings with No. 4 Lubricant. It is recommended that the motor bearings be repacked with No. 4 Lubricant at the same time. Lubricate all points as above and also the Bellcrank bearing.

S. Clean the operating magnet pivots and apply one drop of No. 1 Lubricant to each.

NOTE :—The following lubricants are recommended and may be obtained from Creed & Co. Ltd. :

No. 1. — Thin Oil, such as :—	No. 2. — Medium Oil, such as :—	No. 4. — Grease, such as :—	No. 5. — Grease, such as :—
Shell Oil J.Y.1.	Shell Oil C.Y. 2.	Shell VW.	Mobilgrease No. 2.
Wakefield Spindle Oil.	Wakefield Castrol XL.		Shell "Retinax A."
G.P.O. Oil No. 12.	G.P.O. Oil No. 14.		

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